Draft Environmental Impact Statement on the Proposed Port Fourchon Development Plan, La Fourche Parish, Louisiana

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Coastal Zone Management

UNITED STATES
DEPARTMENT OF COMMERCE

DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED PORT FOURCHON DEVELOPMENT PLAN LAFOURCHE PARISH, LOUISIANA

Prepared by:

Office of Coastal Zone Management
National Oceanic and Atmospheric
Administration
Department of Commerce
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

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This document was prepared by the Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management. For additional information about the proposed action or this document, contact:

Office of Coastal Zone Mangement
National Oceanic and Atmospheric Administration
3300 Whitehaven Street N.W.
Washington, D.C. 20235
Telephone: 202/254-8000

1. TYPE OF ACTION

(x) Administrative ( ) Legislative

2. BRIEF DESCRIPTION OF THE ACTION

As part of the coastal zone management activities of the Federal government, the Secretary of Commerce administers and coordinates a coastal energy impact program (CEIP) under Section 308 of the Coastal Zone Management Act as amended (16 U.S.C. 1451 et seq.). The CEIP provides financial assistance to coastal states and units of local governments within those states to mitigate the on-shore impacts of coastal energy activities.

The proposed action is a loan offer for the amount of $6,300,000.00 to the Greater Lafourche Port Commission to fund the fourth phase of a multiport facility to accommodate the needs of the fishing/seafood industry, recreation/ tourism industry, the offshore oil industry and the Louisiana Offshore Oil Port, Inc. (LOOP). Phase 4 consists of:

a) Dredging a channel and slip and fill in Pass Fourchon as well as relocating and maintaining an entrance channel at Belle Pass;

b) Making stone jetty improvements at Belle Pass (Bayou Lafourche);

c) Dredging and stabilizing a flotation canal;

d) Making drainage improvements; and

e) Constructing a bulkhead for docking facilities.

New construction and improvements will require dredging a total of 2.957 million cubic feet of spoil which will result in an average increase in elevation of 3.84 feet at the spoil sites. Phase 4 is described in more detail in Section 1, pages 6-7.

The port facilities will be wholly owned by the Greater Lafourche Port Commission, a unit of general purpose government as defined in the Coastal Zone Management Act, as amended, Section 308(1)(3). The system of user charges to provide the primary source of repayment of the loan over the 30-year life of the facility is described in the project document files located at the Office of Coastal Zone Management at the above address.

3. SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Short term benefits of granting a loan to construct Phase 4 of the port facilities are an increase in construction-related employment and an increase in disposable income which will be spent for housing and services in the communities near the port site.

Combined with the first three phases of the port development, the long term benefits of this action will affect the economic base of Grand Isle and local communities north of Golden Meadow in Lafourche Parish. The commercial marina, docking facility and warehouses should attract larger shrimp boats and seafood processing industries for a net increase in employment and tax revenues for the Parish. The five-ramp launch for sport boats should attract recreational fishermen who will need services from the local communities. The bridge providing access to the beach should attract land-based day users to the area which will benefit the local economy. Phase 4 will result in the creation of 450 acres of land to provide a site for future industrial and commercial development. If this development occurs, the employment and tax base of the Parish would increase significantly. LOOP, Incorporated, estimated that employment for 250 permanent full time persons would be generated by the offshore oil port. Property tax generated by the LOOP facility was estimated at $32,000 to $49,000 annually.

Short term costs will primarily affect water quality and wildlife habitat. There will be a temporary increase in turbidity and loss of benthic organisms as a result of dredging and onshore construction. The degredation of water quality will reduce the food supply for aquatic species and disrupt breeding and feeding activities of aquatic species and waterfowl in parts of Bayou Lafourche and Belle Pass. Onshore construction will disrupt the breeding and feeding activities of terrestrial species, though the habitat affected has already been disrupted by previous dredge spoil disposal.

Long term costs of Phase 4 can be grouped into five areas: land use, flood problems, recreation, terrestrial wildlife habitat, fisheries habitat and special concerns.

Land use changes involve loss of 55 acres of land for construction of the T-slip and creation of 450 acres of dry land around the T-slip for the industrial/commercial site. The 450-acre site is currently a combination of brackish marsh habitat and old spoil disposal sites. Past spoil disposal has raised the land 6 to 12 inches; project-related dredging will raise the site another 3 feet. If development does not occur immediately at this disposal site, it will accommodate spoil from maintenance dredging for 20 years. As use of the port facilities increases, the rate of beach and shoreline erosion will increase as a result of wave wash from passing vessels.

Storm surges and torrential rainfall will generate floods periodically at the project site. Past floods have attained depths of 10 feet or more in the project area which will be elevated less than 10 feet above mean sea level by fill. The proposed site is within the 100-year floodplain as mapped for the U.S. Department of Housing and Urban Development in May 1971. The project is not presently specifically designed to minimize potential harm to the floodplain, to meet floodproofing standards under the National Flood Insurance Program or to be in compliance with the Flood Disaster Protection Act. However, the facilities are located behind the beach which serves as a natural buffer to reduce the force of storm surges.

Changes in recreational uses at the project site will result in the loss of revenues from current fishing and duck hunting activities when the 450-acre marsh/spoil site is converted to dry land. Providing better access to the barrier beaches is anticipated to increase their use. Increased use will result in the loss of beach vegetation and an increase in the rate of beach erosion. Currently, the shoreline is retreating at a rate of just over 20 meters a year.

As the land at the 450-acre site is committed to roads, warehouses and other industrial/commercial uses, the habitat available for terrestrial species will be reduced. The conversion of the area from a migratory waterfowl feeding area to dry land is a more significant change in habitat than the loss of marginal habitat on revegetated dredge spoils.

The long term loss in fisheries habitat will result from changes in the hydrology of the project area. Widening and deepening the channel at Belle Pass will increase the salinity in Bayou Lafourche and adjacent marsh/estuarine habitats. Two of the most productive estuarine areas in the United States are located immediately to the east and to the west of the project area; they are the Caminada-Barataria and the Timbalier-Terrebonne estuarine systems, respectively. Bayou Lafourche is hydrologically connected to both of these systems and serves as a passageway for the movement of marine organisms into and out of the estuarine areas at different stages in their life cycles. Increases in salinity will create a barrier to this movement of organisms, reducing the productivity of the estuaries. The impact

of saltwater intrusion on the Timbalier-Terrebonne system could be mitigated by restricting water exchange through the tidal streams which connect lower Bayou Lafourche and Timbalier Bay.

Special concerns relate to identified endangered species and archeological sites affected by the project. The project will encroach on the feeding areas of the endangered brown pelican, bald eagle and peregrine falcon near the mouth of Belle Pass. The brown pelican, Louisiana's state bird, was only reestablished in the state coastal zone in the 1960's. The project area also is in the range of three endangered species of sea turtles, but the use of the project area by these species has not been established. Project construction will affect six archeological sites, but only two are significant enough to be eligible for nomination to the National Register of Historic Places. These two sites will be protected from being buried under dredge spoil during project construction. However, increased bank erosion, vandalism and maintenance dredging will affect all the sites over the long term.

4. ALTERNATIVES CONSIDERED

The no action alternative was rejected because of the economic benefits which would be lost. Port Fourchon is strategically located between the LOOP project site and the Lafourche transcoastal corridor. In addition, the first three phases of the port are well underway; failure to fund Phase 4 will not eliminate many of the impacts of the project.

Structural Alternative 1, the Bayou Lafourche and Lafourche Jump Waterway, was rejected because of adverse impacts on archeological sites, saltwater intrusion into a municipal water supply and adverse effects on estuarine ecosystems which include parts of the Point-au-Chien Wildlife Management area and the Wisner Wildlife Management area.

Structural Alternative 2, Widening of Bayou Lafourche, was rejected because of adverse impacts on the human environment, particularly relocation of existing facilities, residences and roads. In addition, widening the bayou would eliminate most of the land suitable for development so that growth would encroach further on wetlands.

Structural Alternative 3, Reducing the Scope of the Project, was rejected because it would foreclose options for responding to future needs of the offshore mineral extraction industry. In addition, implementing this alternative might have the effect of overtaxing the planned facilities at Morgan City in adjacent St. Mary's Parish, described in the U.S. Army Corps of Engineers' Draft Supplement to Final Environmental Statement--Atchafalaya River and Bayous Chene, Boeuf and Black, Louisiana.

Nonstructural Alternative 1, reducing the offshore energy activities, was rejected because it would not be feasible in view of present national energy needs.

Nonstructural Alternative 2, Expanding Other Existing Small Port Facilities in the Region, was rejected because it would result in increased boat traffic through waterways in environmentally sensitive areas of the coastal zone and would induce expansion into wetlands at many sites, rather than concentrating development and wetland losses at one site.

5. DISTRIBUTION

Comments have been requested from the following Federal, state and local agencies and other parties:

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Department of Agriculture
Department of Commerce
Department of Defense
  Department of the Navy
  U.S. Army, Corps of Engineers
  U.S. Air Force
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
Economic Development Administration
Federal Energy Regulatory Commission
General Services Administration
Marine Mammal Commission
National Oceanic and Atmospheric Administration
U.S. Coast Guard
U. S. Department of Energy

NATIONAL INTEREST GROUPS

American Association of Port Authorities
American Bureau of Shipping
American Fisheries Society
American Institute of Merchant Shipping
American Petroleum Institute
American Water Resources Association
American Waterways Operators
Barrier Islands Coalition
Center for Natural Areas
Coastal States Organization

Conservation Foundation
Environmental Law Institute
Gulf South Atlantic Fisheries Development Foundation
Izaak Walton League
League of Women Voters Education Fund
National Association of Dredging Contractors
National Audubon Society
National Fisheries Institute
Natural Resources Defense Council
National Wildlife Federation
Shipbuilders Council of America
Sierra Club
Sport Fishing Institute

STATE/LOCAL AGENCIES

Advisory Board to the Governor's Council on Environmental Quality
Capital Resources, Conservation and Development Project
Central Lafourche Regional Planning Commission
Community Improvement Agency
Crescent Soil and Water Conservation District
Greater Lafourche Port Commission
Jefferson Port Commission
Lafourche Basin Levee District
Louisiana Coastal Commission
Louisiana Department of Conservation
Louisiana Department of Environmental and Development Control
Louisiana Department of Highways
Louisiana Department of Natural Resources
Louisiana Department of Public Works
Louisiana Historical Preservation and Cultural Commission
Louisiana Wildlife and Fisheries Commission
Morgan City Harbor and Terminal District
President's Water Pollution Control Board
Regional Planning Commission
St. Charles Parish Environmental Council
South Central Planning and Development Commissin, Thibodaux
South Lafourche Regional Planning Commission
South Louisiana Tidal Water Control Levee District
State Soil and Water Conservation Committee
Terrebonne Parish Police Jury
Thibodaux Regional Planning Commission
Water Resources Study Commission

OTHER INTERESTED PARTIES

Center for Wetland Resources, Louisiana State University
Sportsmens Committee, Morgan City Chamber of Commerce
Dularge Hunting Club, Inc.

Ecology Center of Louisiana
Orleans Audubon Society
Louisiana Center for the Public Interest
Louisiana Wildlife Federation
Howard Stark Company, Inc.
Student Activity for Environment, Nicholls State University
Woods and Waters Club
WVUE-TV
Individuals who requested copies of the document

LIBRARY INFORMATION CENTERS

Copies of this document were provided to the following libraries:

Assumption Parish
Napoleonville, Louisiana

Jefferson Parish
Metairie, Louisiana

Lafourche Parish
Thibodaux, Louisiana

Orleans Parish
New Orleans, Louisiana

Plaquemines Parish
Buras, Louisiana

St. Bernard Parish
Chalmette, Louisiana

St. Charles Parish
Hahnville, Louisiana

St. Martin Parish
St. Martinville, Louisiana

St. Mary Parish
Franklin, Louisiana

Terrebonne Parish
Houma, Louisiana

6. COMMENT PERIOD

This draft environmental impact statement was transmitted to the Environmental Protection Agency one week before the notice of availability to the public appeared in the Federal Register. Comments should be submitted to the Office of Coastal Zone Management within 45 days after the date of the Federal Register notice.

THE PROJECT AND ITS IMPACTS

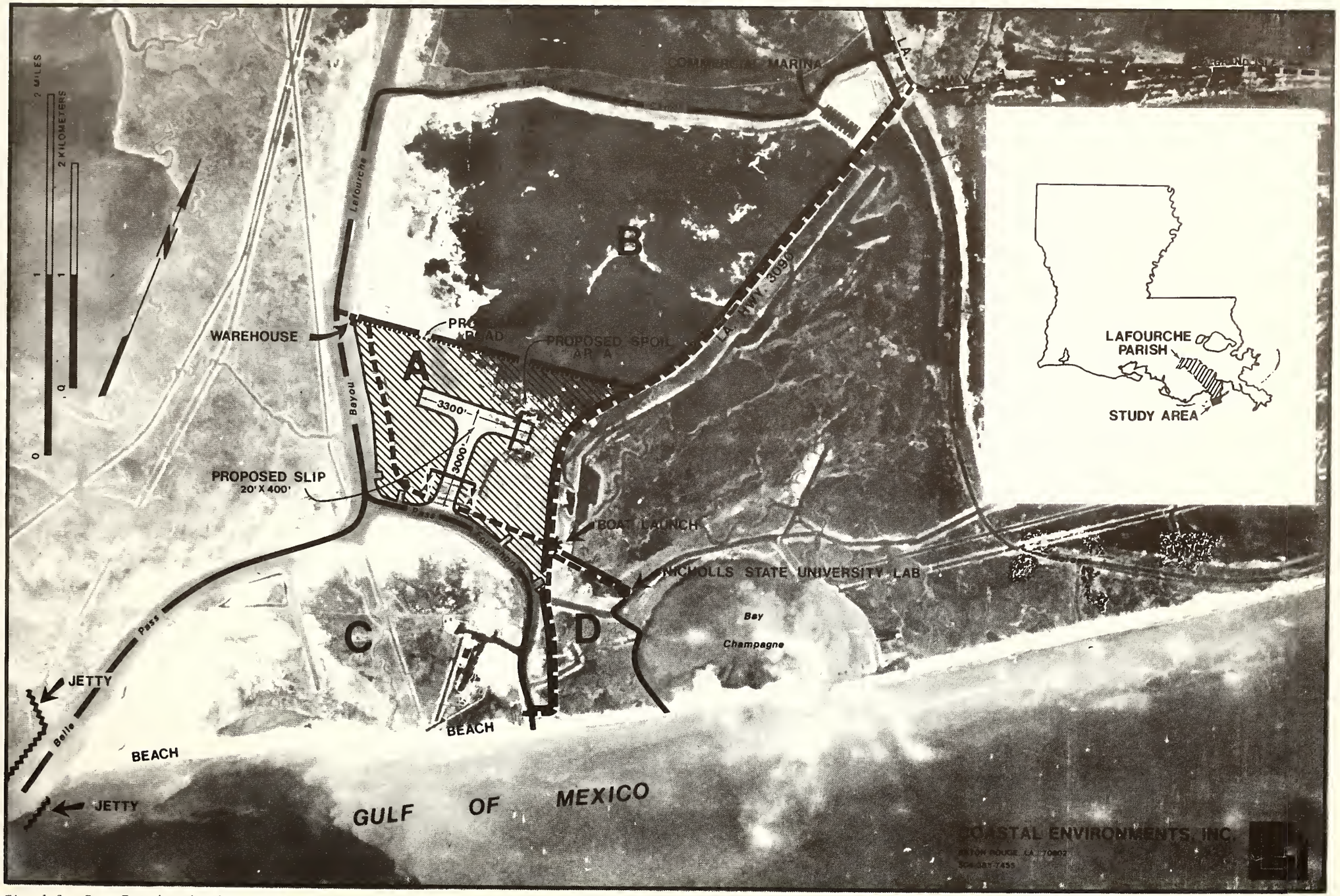


Fig. 1-3. Port Fourchon development plan.

SECTION 1: GENERAL PROJECT DESCRIPTION

A. SITE

The Port Fourchon development is a multi-purpose facility to be completed on a 586 acre site located in the Tenth Ward of Lafourche Parish, Louisiana, where the waters of Bayou Lafourche meet the Gulf of Mexico. The project site lies within a larger tract of approximately 3,800 acres which is under the jurisdiction of the Greater Lafourche Port Commission. The Commission was established in 1960, with full powers of a port, harbor, and terminal district.

The site is located at the seaward end of the Lafourche transcoastal corridor, one of the most important and best established links between the inland areas of the coastal zone and the Gulf of Mexico. This corridor is defined by Bayou Lafourche, an important water transportation artery, and by alluvial ridges along the bayou (Fig. 1-1).

The Lafourche corridor forms a natural boundary between two major estuarine complexes, the Terrebonne system to the west and the Salvador-Barataria system to the east. Each of these systems is highly productive and represents a major resource (Fig. 1-2). To maintain the integrity of these systems and provide for environmental management, these systems must be retained as natural entities. Development related to oil and gas industry and fisheries must therefore be concentrated to the greatest extent possible on the higher boundaries of the units rather than be allowed to disperse through canals, roads, and other hydrologic alternatives with resultant fragmentation of the system. The Port Fourchon development follows this principle in that it confines activities and related primary and secondary impacts to an existing corridor.

As shown in Fig. 1-3, the total tract is comprised of four major components. Component A is the project area. Of the 586 acres lying within this component, 55 acres will be occupied by the proposed T-slip and 450 acres of spoil-filled area will be committed to other aspects of the project development. Component B is an impounded wetland 2284 acres in extent. As shown in Fig. 1-3, an existing commercial marina presently lies in the northeastern part of this component. Component C is a 1316 acre area consisting primarily of wetlands bounded by Belle Pass and Pass Fourchon on the west and east and by the Gulf shore on the south. There is presently some petroleum industry related activity in this component. Component D of the tract lies between Pass Fourchon and Bay Champagne. Nicholls State University presently maintains a coastal and marine research laboratory in this component.

B. RELATIONSHIP OF THE PROPOSED ACTION TO THE TOTAL PROJECT

It is proposed that the fourth phase of a multiport facility be implemented under the guaranteed loan provisions of the Coastal Energy Impact Program. The facility will accommodate the needs of: 1) the fishing and seafood industry, 2) recreation and tourism, 3) the offshore

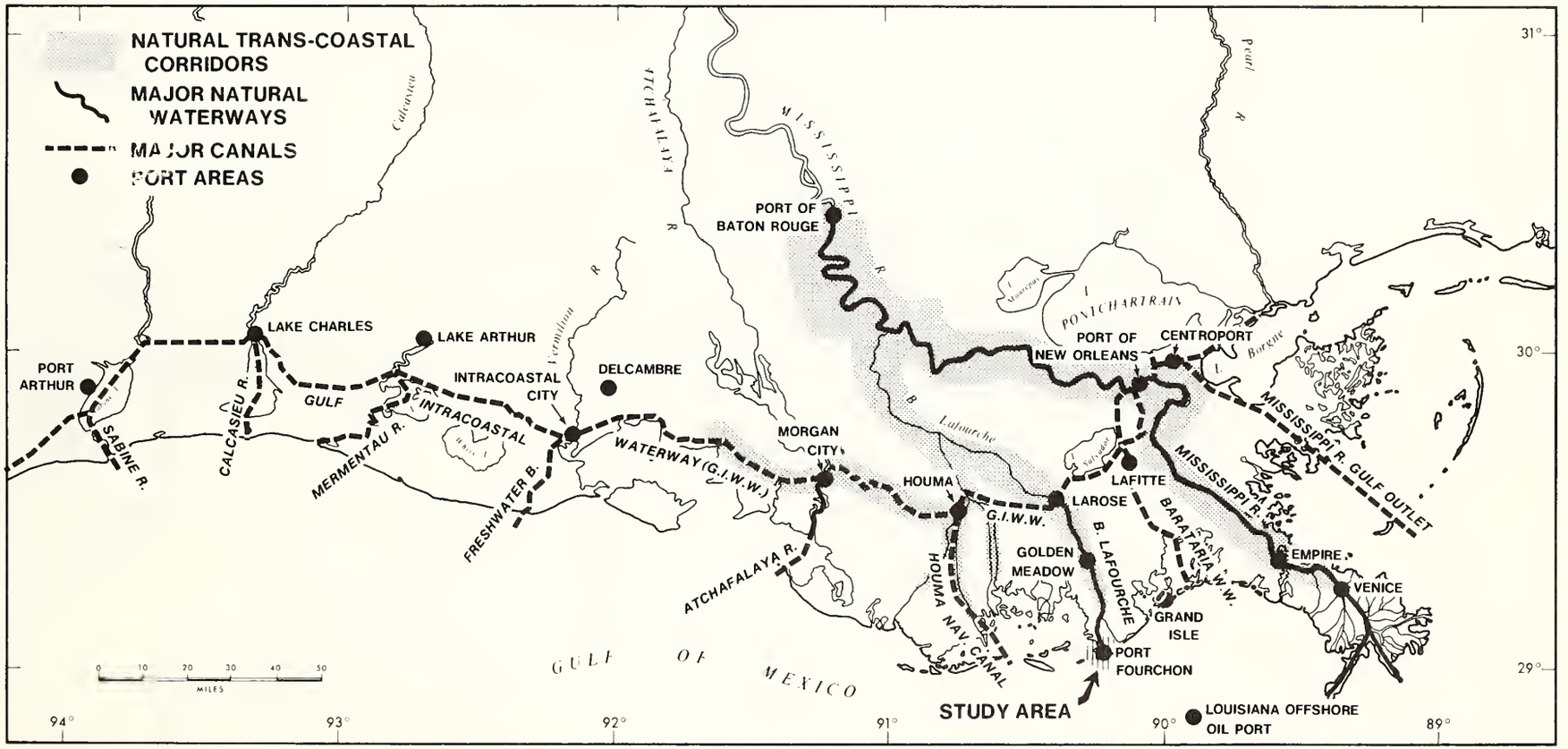


Fig. 1-1. The Bayou Lafourche transcoastal corridor.

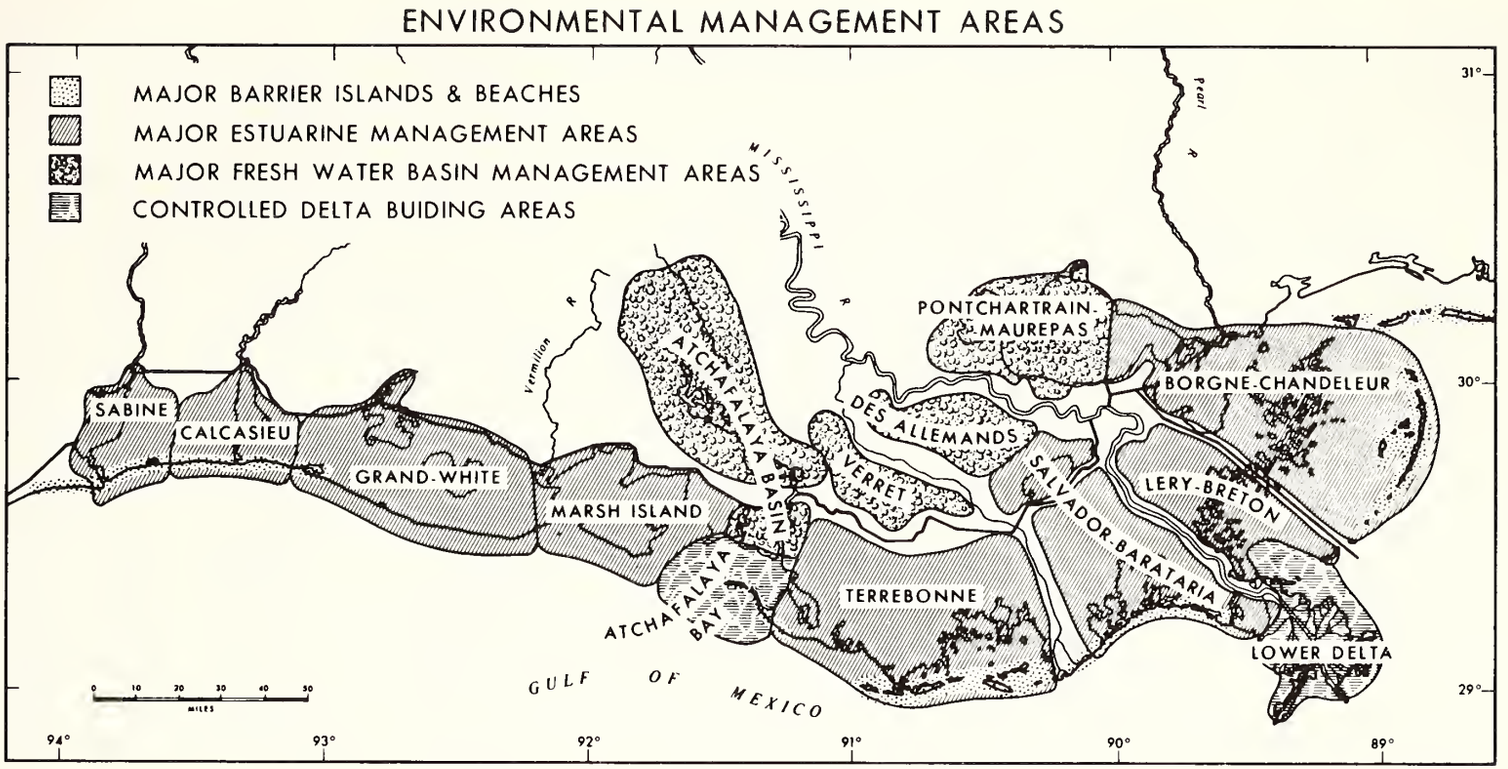


Fig. 1-2. The Lafourche corridor located between Terrebonne and Salvador-Barataria estuarine areas.

oil industry, and 4) the Louisiana Offshore Oil Port, Inc. (LOOP), the first licensed superport in the United States.

The multiport facility is designed to serve the fishing and seafood industry, recreation and tourism, the offshore oil industry, and the proposed oil superport. Available at the port will be terminal and docking facilities, industrial sites for fabrication yards for offshore drilling rigs, and recreation facilities, including access to one of the few beaches on the Louisiana coastline. An integrated plan of the utility system (energy and water distribution and waste disposal) will be included in the final stages of construction. Proper access to the development sites is provided by roads and direct water routes whenever possible, by frontage on Bayou Lafourche itself, and on the T-slip on Pass Fourchon (see Fig. 1-3).

The proposed project is an addition to an existing complex. The total Port Fourchon development by the Greater Lafourche Port Commission includes seven distinctive but interrelated phases, three of which have been completed. The phases are as follows:

Phase 1 - Phase 1 has been completed by the Greater Lafourche Port Commission at a cost of $4.2 million. This phase consisted of the deepening and widening of Belle Pass to a channel 20 ft by 300 ft, west of the existing channel from Mile 0.76 in Bayou Lafourche to a 20 ft depth in the Gulf of Mexico, and of a flotation canal which links Bayou Lafourche with the commercial marina, making it accessible to large shrimp boats (Fig. 1-3). During this phase the commercial marina (with a capacity of 68 large shrimp boats) was constructed, as well as a docking facility and warehouse on Bayou Lafourche, a water distribution system with a 300,000 gal elevated storage tank, and a five-ramp launch for sportscraft. Other projects included in this phase were the construction of levees for flood and hurricane protection, the extension of Highway 3090, and a bridge to provide access to the beach.

Phase 2 - This phase, completed in 1975, consisted of the improvement of the small jetty at Belle Pass, extending it outward some 500 ft into the Gulf of Mexico. The jetty on the western side was extended a distance of 2100 ft from the existing shoreline (Fig. 1-4). Work was completed at a cost of $2,100,000.

Phase 3 - Phase 3, under construction at the present time at a cost of $498,000, consists of a preliminary clam shell surface road that will allow easy access to future industrial and commercial development sites and to all port areas.

Phase 4 - The fourth phase of the development program, planned at a cost of $5,250,000, consists of:

a) Dredging a channel and slip and fill in Pass Fourchon left descending bank, at a point about 1.7 mi above the mouth of the waterway, approximately 8 mi southerly from Leeville, Louisiana, in Lafourche Parish; and relocating and maintaining an entrance channel at Belle Pass (20 ft x 300 ft).

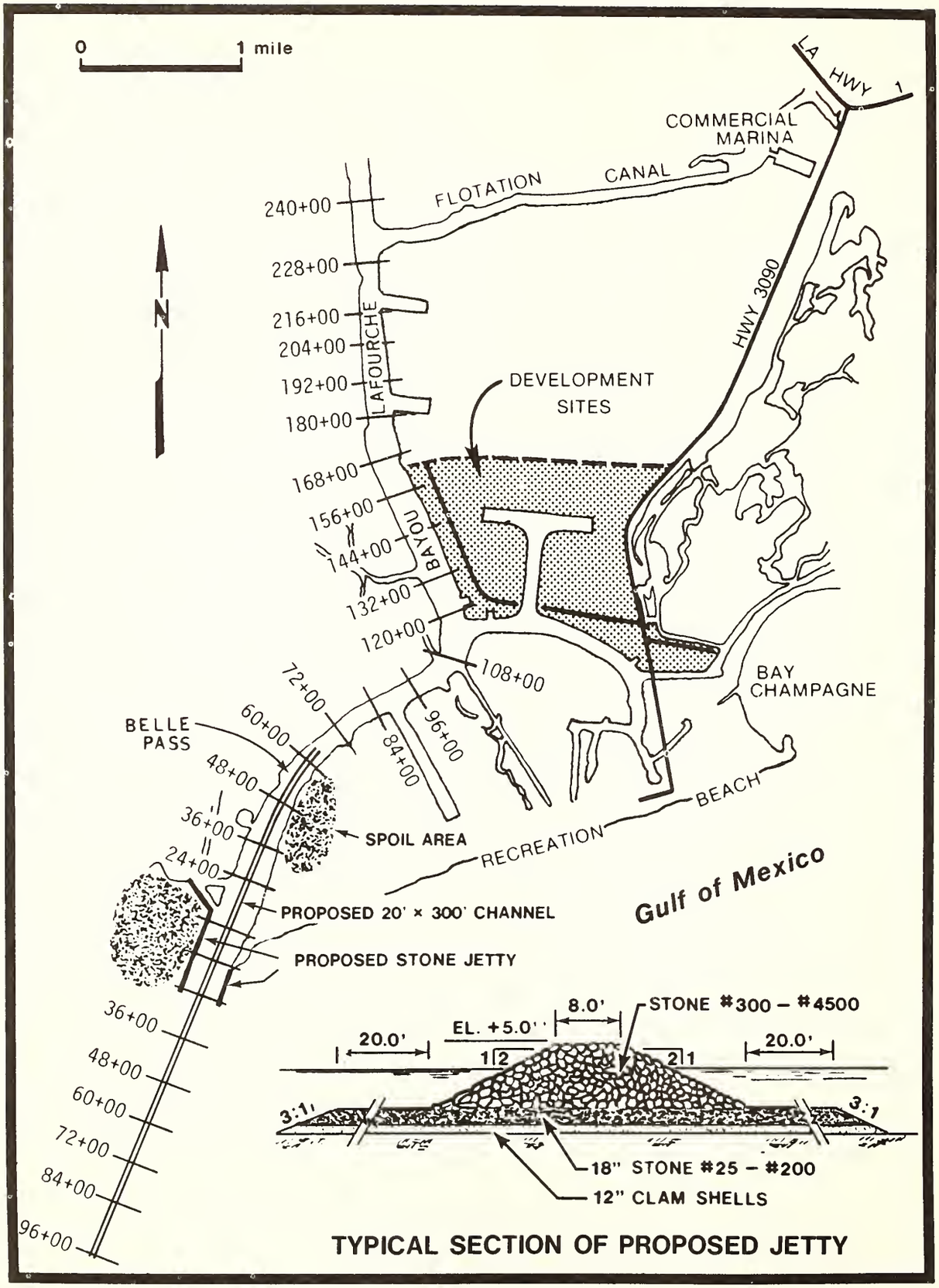


Fig. 1-4. Jetty improvements in Belle Pass (after Picciola & Associates).

b) Stone jetty improvements at Belle Pass (Bayou Lafourche)

c) Flotation canal

(1) Bank stabilization

(2) Dredging

d) Drainage Improvements

e) Bulkhead for docking

Phase 4, parts a, b, c, d and e, have been granted permits from the Corps of Engineers, New Orleans District, under Section 10 of the Rivers and Harbors Act of March 3, 1899 (33 U.S.C. 403); and under section 404 of the Federal Water Pollution Control Act (86 Stat. 816, P. L. 92-500).

The dredging of the 20 ft x 400 ft slip will produce two million cu yds of sand for filling approximately 450 acres, thus providing a suitable foundation for future industrial and commercial development. The fill material will be allowed to settle before any type of construction commences. Drainage improvements to the site so created will be undertaken during this phase, as part of its preparation for development. Swale ditches dug with a small dragline will be provided throughout the area.

Dredging will be primarily by hydraulic suction using heavy equipment for most additional work. The dredge material will be pumped into the area proposed to be filled, which is at present about 70% leveed (levees were constructed at an earlier date), with a number of sluice gates to allow water to run out from the site.

Bulkheading along Pass Fourchon is planned during Phase 4, to aid the development of docking facilities and to prevent any further erosion or washing away of the existing bank. The work will consist of the back system with bumpers.

The stone jetty improvements will consist of adding stones over the top of the stone jetty to increase its height, plus extending the east and west jetty into the Gulf for a safer channel entrance.

The work at the flotation canal consists of placing rip-rap along each bank at its intersection with Bayou Lafourche and also on the south side of the Fourchon Road. Some of the existing bank will be reshaped as necessary for the placement of the rip-rap. The dredging operation will consist of removal of 330 cubic yards of material to be deposited along with approximately 360 cubic yards of rip-rap along the project site shoreline.

Phase 5 - Under phase 5 the Police and Administration building will be constructed. A 12-in water main with all necessary connections throughout the 450 acre development will be installed, and a sewage

system will be built. This system will provide for extended aeration and tertiary treatment. Total cost of this phase will be $1,199,750.

While Phases 1 through 5 address existing needs in the area, Phases 6 and 7 are included to indicate the possible maximum future development of the port. Permits for Phases 5, 6, and 7 have not yet been requested from the Corps of Engineers. Applications will be submitted as the project evolves; environmental reviews will be performed at that time.

Phase 6 - Future needs for repair or fabrication of offshore rigs and platforms may require deeper navigation depths in Belle Pass. It is estimated that increasing the channel to 30 ft x 500 ft dimensions would cost $4,000,000. Stone jetty improvements consistent with the increased channel dimensions would cost an additional $2,000,000.

Phase 7 - Phase 7 consists of additional bulkheading as required to control erosional problems; the expected cost is $2,500,000.

C. OPERATION AND MAINTENANCE

Operation and maintenance of dredge channels and spoil sites would be a responsibility of the Greater Lafourche Port Commission. The existing channel from Mile 0.76 in Bayou Lafourche to the 20-ft depth in the Gulf of Mexico would be maintained at no less than 12 ft x 125 ft by the Port Commission. Maintenance of the entrance channel in the Gulf and between the jetties will be accomplished by hydraulic dredge. Material dredged from this reach will be disposed in the two areas already designated as spoil areas. Material dredged from the proposed T-slip will be used as fill material for the creation of the commercial and industrial sites on the 450-acre site as shown in Fig. 1-3. Maintenance dredging of the Bayou Lafourche project channel will be by hydraulic suction dredge. Dredge material will be placed in existing disposal areas which have been used for this purpose before by the Corps of Engineers.

The frequency of maintenance dredging in the project area ranges from once every 5 years to about once every 10 years. Therefore, existing disposal sites should be adequate for 20 years.

SECTION 2: PURPOSE OF PROJECT

A. AREA AND COMMUNITIES AFFECTED

The Port Fourchon facility will affect an area of approximately 1000 sq mi in coastal-central Louisiana. The area extends southward from the Gulf Intracoastal Waterway to the Gulf of Mexico and along the coast from the Houma navigation canal to Grand Isle. Parishes partly within this area include Terrebonne, Lafourche, and Jefferson.

The communities to benefit from the Port Fourchon facility as a result of economic growth are primarily those along Bayou Lafourche in Lafourche Parish and Grand Isle in Jefferson Parish. Communities in Lafourche Parish include Lockport (population 2000), Larose (population 4300), Cut-off and Galliano (combined population 10,000), Golden Meadow (population 2700), and Leeville (population 1000). Grand Isle has a population of 2300.

B. NEED FOR PROJECT

Two coastal energy activities are partially triggering the proposed project. The first is the expanding Outer Continental Shelf oil and gas exploration and production. The second is the construction of the Louisiana Offshore Oil Port, a supertanker monobuoy system 20 mi south of Port Fourchon. The proposed project is partially generated also by the increasing difficulty for Bayou Lafourche to accommodate fishing industry related navigation.

C. ECONOMIC STATUS

The Port Fourchon development program would directly and indirectly provide jobs in the lower Lafourche Parish area by developing a port facility capable of meeting the needs of offshore petroleum industries, creating land for commercial, industrial, and recreational enterprises, and heightening the beneficial economic effects of superport activities in the area by providing a service center.

Because of the port's location at the mouth of Bayou Lafourche, and the multiple facilities that would be made available by the planned Port Fourchon development program, many industries may be attracted to the area, especially those related to the main economic activities characteristic of this area: fishing and seafood industry, recreation, offshore oil, ship and boat building and repairing, and the proposed Superport. The exact nature of the impacts of the Port Fourchon development program on such indices as employment, earnings, disposable income, tax base, etc., are dependent on the type, scale, and staging of development activities and market absorption.

In a 1974 study sponsored by the Greater Lafourche Port Commission, the Gulf South Research Institute (GSRI, 1974) identified potential users of the port facilities and projected their associated economic impacts. Indices were developed for various types of businesses that might locate in Port Fourchon. These indices not only measure the effect of new establishments, but also compare the inputs of different types of industries. Since establishments related to either the offshore oil industry or the commercial fishing industry covered a wide range of operational alternatives, no single industry index could be used as a valid model. Thus, GSRI developed a composite model by averaging the statistics for each type of industry. Impact indices for employment, earnings, value added, value of shipments, and capital expenditures are thus presented for the major industry types that would be expected to locate in the port area according to GSRI (Tables 2-1, 2-2, and 2-3).

Table 2-1. The average effect of the location of a new establishment (offshore oil associated) in Port Fourchon.

Average Per Establishment	SIC 3533 Oilfield Machinery	SIC 3731 Ship Building	SIC 3732 Boat Building	SIC 3599 Miscellaneous Machinery
Employment	600	378	38	13
Payroll	7,185,000	4,530,925	346,200	95,513
Production Workers	500	310	32	11
Wages	5,250,000	3,624,740	276,960	72,328
Value Added	9,000,000	8,815,600	496,200	167,529
Cost of Materials	21,000,000	12,540,400	538,800	79,350
Value of Shipments	30,000,000	21,356,000	1,035,000	245,681
Capital Expenditures	600,000	364,700	20,000	11,854
Net of Value Added Minus Payroll	3,750,000	4,284,675	150,000	72,016
Book Value	10,000,000	7,000,000	375,000	

Source: Gulf South Research Institute compiled from "Census of Manufacturers" material.

Based on the assumptions that the strategic location of Port Fourchon, the port facilities, protection of property, and the present trends toward expansion of the offshore oil industry would cause Port associated facilities, as well as at least one large offshore fabricator, to locate in the Port Fourchon area, the direct and indirect effects of the Port Fourchon development project are summarized on Table 2-4.

It is important to note that the GSRI study was based on the assumption that 1,000 acres would be available for development. However, the current short range development plan of the Port Commission

(through Phase 4) envisions only the development of 586 gross acres (450 net acres excluding land set aside for the creation of a T-slip). Therefore, the GSRI estimates of the overall impact should be revised substantially downward. Tables 2-1, 2-2, and 2-3 provide a useful framework for estimating the likely impacts of particular industries -- if those industries were to locate at Port Fourchon. Due to the absence of current marketing data, quantitative projections of economic impacts are of questionable value or validity. For instance, Phase 4 development entails site preparation for commercial and industrial uses on land that will be leased by the Port Commission. However, the installation of a sewage treatment system is not called for until Phase 5. The presence (or lack thereof), capacity, and financing of the sewage treatment system will necessarily impact the suitability and marketability of the site for certain types of commercial and industrial users. While the GSRI study projected that one large offshore fabricator would be likely to locate at the port, it is unclear at this time whether the necessary site improvements and land will be available under Phase 4 to support such a facility.

Table 2-2. The average effect of the location of a new establishment (oilfield service) in Port Fourchon.

Average Per Establishment	SIC 3441 Fabricated Structural Steel	SIC 3443 Platework	SIC 3444 Sheetmetal Work	SIC 3449 Miscellaneous Metal Work
Employment (Number)	55	66	22	50
Payroll	$394,693	$478,089	$160,675	$340,062
Production	41	50	17	36
Wages	$260,153	$325,939	$110,020	$211,710
Value Added	$673,112	$951,126	$291,192	$691,217
Cost of Materials	$828,877	$890,034	$303,700	$981,818
Value of Shipments	$1,514,183	$1,835,153	$593,451	$1,667,180
Capital Expenditures	$39,081	$55,904	$14,538	$39,908
Net of Value Added Minus Payroll	$278,419	$411,945	$130,517	$351,155
Book Value	$409,130	$557,779	$158,704	$384,088

Source: Gulf South Research Institute compiled from "Census of Manufactures" material.

The construction of LOOP will have a positive economic impact on Port Fourchon in that LOOP, Inc., has currently leased space at the port for its boat crews that will service the offshore platforms. It is likely that the LOOP project will attract related industries and commercial enterprises to Port Fourchon to service its boats and

Table 2-3. The average effect of the location of a new establishment (port related) in Port Fourchon.

Average Per Establishment	SIC 2031 Can and Cured Seafood	SIC 2036 Frozen Seafood	SIC 42 Field Service	SIC 1621 Heavy Construction	SIC 1791 Structural Steel Erection	SIC 13 Oil and Gas Extraction
Employment	55	43	37	31	21	15
Payroll	$215,937	$155,331	$653,549	$259,507	$166,188	$113,406
Production Workers	44	39	32	26	19	10
Wages	$171,250	$120,724	$619,549	$207,816	$142,560	$66,719
Value Added	$565,628	$331,790	$3,483,549	$434,183	$283,493	$818,823
Cost of Materials	$1,068,750	$792,354	$8,816,451	$385,384	$104,265	
Value of Shipments	$1,634,687	$1,121,529	$12,300,000	$819,565	$387,756	$1,067,117
Capital Expenditures	$30,625	$18,913	$11,343	$31,511	$13,020	$98,013
Net of Value Added Minus Payroll	$349,668	$176,459	$2,830,000	$174,676	$117,305	$705,417
Book Value	$374,675	NA	$380,000	NA	NA	NA

NA-Not Available

Source: Gulf South Research Institute compiled from "Census of Manufactures" material.

Table 2-4. Direct and indirect impact of the Port Fourchon development.

Item Affected	Direct	Indirect	Total
Population	371[a]	1,197	1,558
Household	371	371	742
Personal Income	$3,633,510	$2,634,100	$6,267,610
Bank Deposits	$ 185,000	$1,187,200	$1,372,200
New Retail Establishments	--	11	11
Employment	371	241	612
Retail Sales	$1,453,403[b]	$1,228.010	$2,681,413

[a]Due to almost total employment in the parish it is felt that all direct employment will cause workers to migrate into the parish.

[b]Retail sales cover only those sales resulting from personal spending.

The combined land and related impact of the development was thus estimated to be $16,152,723.

Source: Gulf South Research Institute, 1974.

offshore needs. Excluding the temporary increase in employment activity associated with the construction of LOOP (including the platforms, piping, pumping station, and salt dome storage facility) that may create short-term positive secondary economic impacts on the Port; LOOP, Inc., currently estimates permanent full time employment to amount to 250 persons. LOOP, Inc., estimates that approximately one-half of its workers will reside in Lafourche Parish. In addition to serving as a port user, LOOP will provide significant tax revenues to Lafourche Parish through the property tax. The Port Commission, whose revenues are in part derived from the property tax, will benefit. In a study conducted for the office of Coastal Zone Management by Peat, Marwick, Mitchell and Company, it was estimated that the Port Commission would receive an additional $32,000 to $49,000 annually from property tax generated by LOOP. (The range reflects the low and high option development schedules of LOOP, Inc.).

In summary, the economic impacts of the Port Fourchon development program are difficult to identify at this time. Such issues as specific land uses and their availability, staging of improvements (i.e., installation of sewage treatment facilities), and the development of a marketing program need to be resolved before an adequate economic analysis can be performed.

SECTION 3: PROJECT ALTERNATIVES

This section will describe the range of options from which the proposed action was chosen, the adverse and beneficial environmental impacts of those options, and the reasons the various options were not chosen.

A. NO BUILD ALTERNATIVE

This alternative would involve the decision to halt further development of the multi-purpose project. As the first three phases of the project have been implemented, this alternative would apply to phases 4 through 7.

1. General Description of the Alternative

a) Objective of the Action

The objective of the no build alternative would be to restrict further development at the Port Fourchon site.

b) Site and Area Description

If no additional phases of the port project were implemented the area would continue to undergo changes from natural and human-induced processes. The already diked area would continue to hold freshwater and give refuge to waterfowl and mammals, and the marshes would continue to revert to open water conditions as a result of subsidence. The area below Pass Fourchon and the Gulf shore would continue to deteriorate and erode at present rates. Some increased development would probably occur in the vicinity of the commercial marina and the petroleum industry installations on Pass Fourchon.

Construction and operation of the LOOP facility and increasing offshore service activity will result in heavier use of small ports throughout the area. If Port Fourchon is not further developed, this will be directed toward Venice, Empire, Grand Isle, Lafitte, Larose, and Houma (see Fig. 1-1). In all of these ports, with the exception of Grand Isle, the increased traffic will be along inland waterways which traverse environmentally sensitive areas of the coastal zone.

2. Adverse Impacts

Adverse impacts of the no build alternative would include increased bank erosion, water pollution, and maintenance dredging on waterways leading into other small ports of the area. Most of these lie within fragile estuarine environments. In addition to this impact on fish and wildlife, archeological sites along these waterways would be further degraded through erosion should the no build alternative be chosen.

Failure to implement the project would mean that navigation, recreation, transportation, and economic benefits attributable to the project would be foregone.

3. Beneficial Impacts

Beneficial impacts relate primarily to increased economic benefits to locales in the immediate vicinity of other existing small ports.

4. Decision on this Alternative

Because of the strategic position of Port Fourchon in reference to the LOOP project and the Lafourche trans-coastal corridor, as well as the present status of project development (thru Phase 3), the no build alternative was rejected.

B. STRUCTURAL ALTERNATIVE 1: BAYOU LAFOURCHE AND LAFOURCHE-JUMP WATERWAY

This alternative is a project authorized by the River and Harbor Act of 14 July 1960, House Document 112, 86th Congress through modification of the River and Harbor Act of 30 August 1935, House Document 45, 73rd Congress. The project has not been funded at present. Public hearings have been held revealing strong opposition to the project and a Draft Environmental Impact Statement has been prepared (U.S. Army Corps of Engineers, New Orleans, 1972).

1. General Description of the Alternative

Project features are shown in Fig. 3-1. One project feature is channel enlargement through dredging of Bayou Lafourche from Thibodaux to the Gulf of Mexico, including the mouth of Belle Passe to the 20 ft depth in the Gulf. This feature has been completed since 1968 under the original authorization.

The second feature is the Bayou Lafourche auxiliary channel parallel to and to the west of Bayou Lafourche providing a bypass between Leeville and Larose.

The third feature is the Lafourche-Jump Waterway which follows the Southwestern Louisiana canal from Leeville to Caminada Bay, and proceeds through the bay to and through Bayou Rigaud shoreward of Grand Isle.

a) Objective of the Action

The objective of the overall channel system is to provide safer navigation and more efficient operations in the movement of materials and equipment to and from oil, gas, and sulphur-producing areas, the movement of shell, shrimp, and oysters by fishing vessels, the provision of an evacuation route, and refuge from Gulf storms and tropical hurricanes.

The Lafourche-Jump feature of the proposed plan would facilitate east-west movement of vessels carrying fish and oilfield supplies between Bayou Lafourche and the highly productive areas to the east. This route is navigated at the present time only by smaller boats and shallow draft barges with considerable difficulty, requiring additional time and power to negotiate. Implementation of the plan would provide a more readily navigable and shorter route to Barataria Bay and surrounding waters from Bayou Lafourche by the larger vessels currently in use.

The auxiliary channel would alleviate navigation hazards along Bayou Lafourche. Expansion of both oil and fishing operations has exceeded the physical limitations of the bayou to accommodate the water traffic adequately. The restricted channel width is further reduced by overhanging buildings and wharves to which numerous small

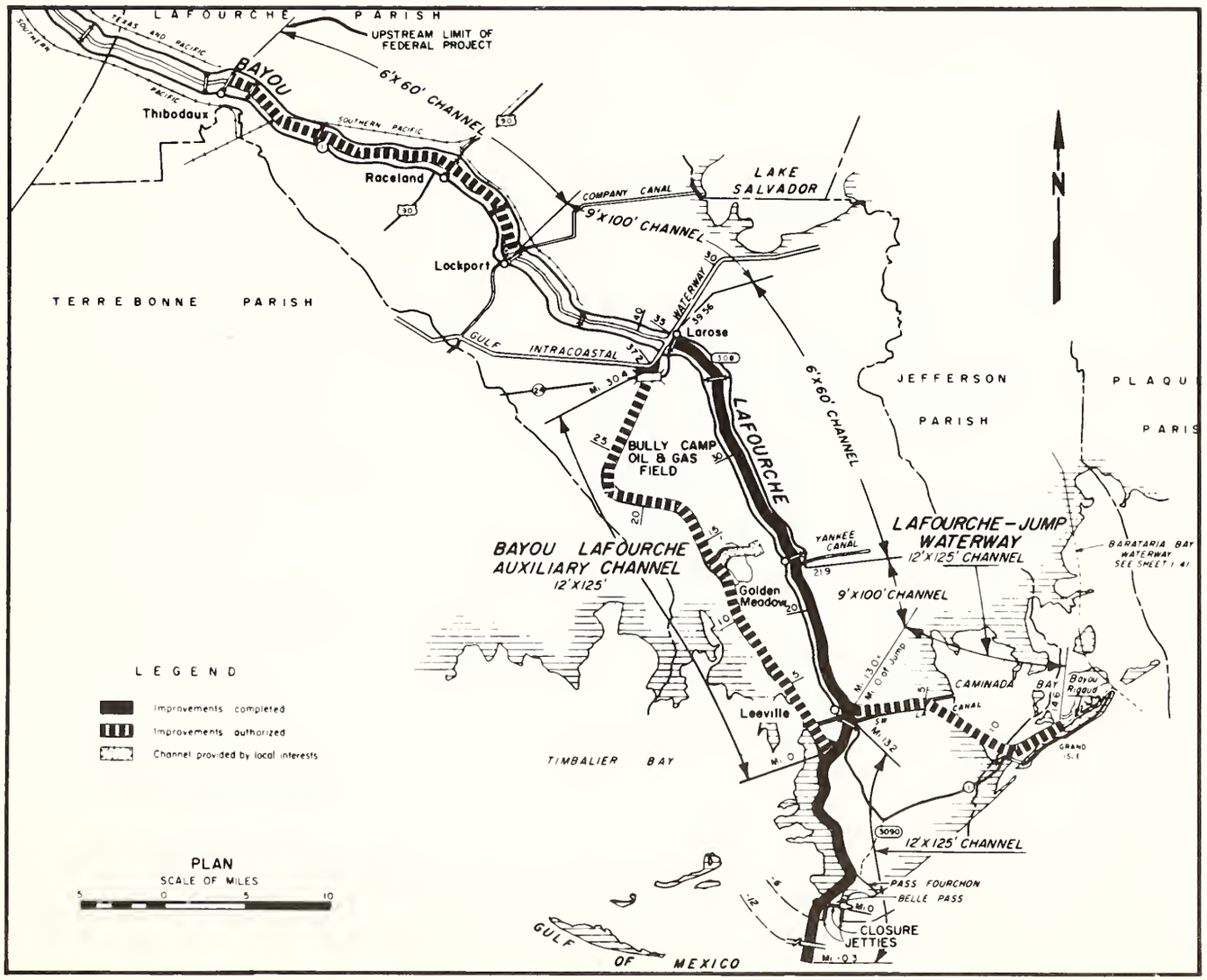


Fig. 3-1. Bayou Lafourche - Lafourche Jump Waterway.

vessels are moored. Barges cannot be loaded to capacity and a reduction of speed is necessary in order to keep wave wash to reasonable limits, thereby preventing damage to moored vessels and structures. Movement of large oil barges and drilling equipment over the bayou is exceedingly difficult in the narrow waterway. On windy days, an extra tug is employed in an effort to hold the tow straight and avoid collision damage. Construction of the auxiliary channel would facilitate use of larger, more modern vessels used in fish and oil industries and thus eliminate the need to use circuitous routes by way of the Gulf Intracoastal Waterway (GIWW).

b) General Design

General design features are as follows. The completed enlargement of Bayou Lafourche would include a 9 ft by 100 ft channel from Lockport to Larose, a 6 ft x 60 ft channel from Larose to Golden Meadow, a 9 ft x 100 ft channel from Golden Meadow to Leeville, a 12 ft x 125 ft channel from Leeville to the Gulf, and a 20 ft x 300 ft channel from Belle Passe to the 20 ft contour in the Gulf. From Larose to Leeville spoil would be contained and effluent returned to the waterway. From Leeville to the Gulf, spoil would be placed along the east bank of Bayou Lafourche and Belle Pass.

The Bayou Lafourche auxiliary channel would be 30.4 mi long, 12 ft deep, and 125 ft wide. It would include a 12 ft by 125 ft stub channel toward Golden Meadow with a turning basin 1300 ft long and 600 ft wide. Spoil would be contained with retention dikes and spill boxes and effluent would be returned to the dredged channels.

The Lafourche-Jump Waterway would provide a 12 ft x 125 ft channel. Where traversing wetlands spoil would be retained along the banks of the channel. Where traversing bays spoil would be placed on adjacent water bottoms.

c) Site and Area Description

The action does not include specific facilities other than the location of the channel which is given in Fig. 3-1. To achieve the objectives of the proposed Port Fourchon facility it is anticipated that the need for service to the fishing and offshore oil industry would be accommodated by increased use or expansion of existing docking facilities and industries along Bayou Lafourche within the various communities.

Bayou Lafourche is a narrow coastal stream flanked by natural levee ridges representative of a development corridor. On either side of the corridor exist major, highly productive estuarine complexes that grade from saline bays through saltwater, brackish water, and freshwater marshes into freshwater swamps (Fig. 3-2).

Development along Bayou Lafourche includes agriculture on the wide ridges north of Golden Meadow. Between Thibodaux and the Gulf there are some fourteen communities with a total population of approximately 30,000. Toward the Gulf of Mexico communities are increasingly dominated by economic activities that are related to the fishing industry and offshore services for the oil and gas industry. Continuous development ends

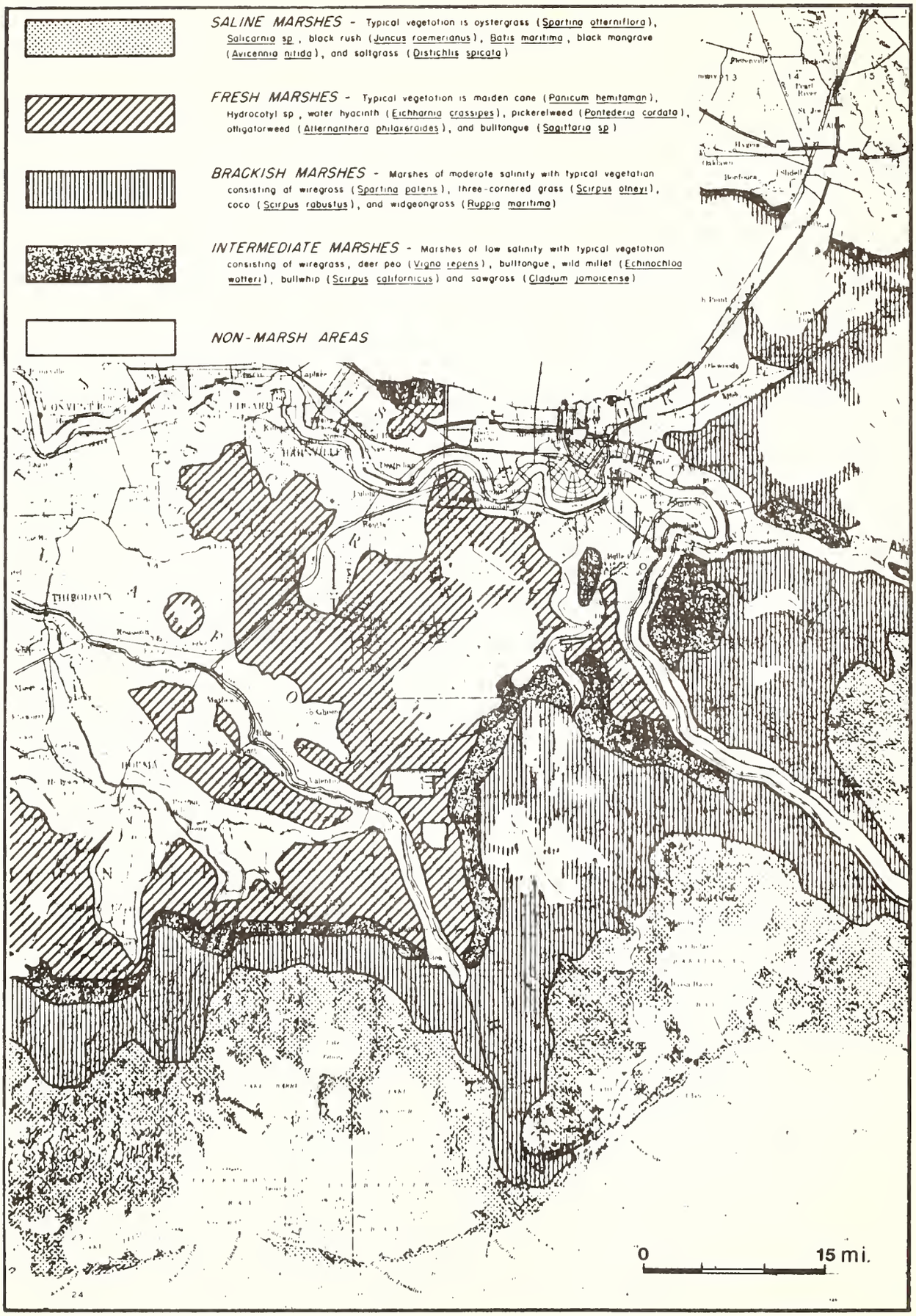


Fig. 3-2. The Bayou Lafourche corridor in relation to its flanking estuaries.

in downstream direction at Golden Meadow. Below Golden Meadow the natural levee width is only sufficient to provide for a road which follows the west bank to Leeville. Above Golden Meadow development and roads are present on both sides of Bayou Lafourche.

The Bayou Lafourche feature of the present alternative is confined to Bayou Lafourche itself and has been completed. The surrounding environment during construction was as described above and has remained unaltered except for modifications due to spoil disposal along Lower Bayou Lafourche and along Belle Pass at the Port Fourchon project site. These spoil areas are presently revegetated along the left descending bank of Bayou Lafourche below Golden Meadow and provide for a road and warehouse at the Port Fourchon project site.

Channel enlargement of Bayou Lafourche has led to increased boat traffic and an associated increase in bank erosion.

The environment of the Lafourche auxiliary channel is entirely composed of highly productive wetlands including saline marsh, brackish marsh, fresh marsh, and the associated tidal and drainage channels. During construction of the channel the major change would be an increase of turbidities at dredging sites, the presence of the dredge and supporting vessels, and an increase in ambient noise levels. Perceptible changes after dredging would be the spoil deposits flanking the channel, an increase in water turbidity due to traffic, an increase in ambient noise levels, marsh deterioration as a result of saltwater intrusion into brackish and freshwater marshes, and marsh deterioration as a result of impoundment and other changes in the hydrologic regime.

The environment of the Lafourche-Jump Waterway is similar to the above wetland environment including in addition an open bay with oyster grounds. Perceptible changes during construction would include increased turbidity and increased ambient noise levels. Alterations after construction would be less severe partly because the channel would make use of an existing canal through the wetlands. Vegetation on present spoil lands would be killed, but would revegetate within four to five years. Increased channelization would cause saltwater intrusion and spoiling would affect oyster bottoms.

d) Existing Use and Environment Physically Affected

Existing use of the area with regard to the Bayou Lafourche feature includes agriculture, rural residential development, and service facilities and industries associated with fisheries and oil and gas extraction. These uses occupy both banks of Bayou Lafourche as far south as Golden Meadow and are isolated at Leeville and Port Fourchon. The remainder of the area is occupied by wetlands and bays and is used for propagation of fish and wildlife, commercial fisheries, trapping, sport fishing, and other forms of recreation. A number of oil and gas fields are developed in the wetlands. Associated canals and natural waterways serve navigation.

Due to low discharge, development along its banks, waste discharges, and non-point source pollution from agriculture and developed lands, Bayou Lafourche is a relatively low quality stream. Discharge ranges from 100 to 400 cu ft per sec (cfs). Dissolved oxygen values show that average quality of the water is barely above the legal standard (4 mg/l) and minimum values fall below that standard. These low quality conditions apply primarily upstream of Golden Meadow. Further downstream quality becomes higher due to increased mixing with estuarine waters through auxiliary canals and absence of development.

2. Adverse Impacts

The estuarine systems that would be affected by the Lafourche auxiliary waterway and Lafourche-Jump Waterway are a prime renewable resource. These systems account for more than half of Louisiana's fisheries production and through export of detrital material play an important support role with regard to marine fisheries in the Gulf of Mexico. Equally important is the role of these systems as breeding and nursery grounds for shrimp and fishes. The marshes serve also as major wintering grounds for migrating waterfowl.

Dredge and fill activities would destroy about 20,000 acres of wetlands and water bottoms. Of these approximately 2000 acres lie within the Point-au-Chien Wildlife Management area and in the Wisner Wildlife Management area in Terrebonne and Lafourche Parishes respectively.

The area encompassed by the Lafourche-Jump Waterway and auxiliary channel include a number of archeological sites. At least six sites would be directly affected and five sites are known to be present in the immediate vicinity of the proposed routes.

Another major consideration is the effect of increasing salinities through saltwater intrusion in the Lafourche auxiliary channel. This effect would extend into the Gulf Intracoastal Waterway to the extent that it would interfere with its use as an industrial and municipal water supply for the city of Houma in Terrebonne Parish.

3. Beneficial Impacts

The Bayou Lafourche and Lafourche-Jump Waterway alternative would provide more efficient and safer navigation into and out of the area.

4. Decision on this Alternative

This alternative was rejected because of the severe nature of adverse impacts on wetlands and related uses. Present losses of wetlands in Louisiana as a result of subsidence, saltwater intrusion, channelization, spoil disposal, impoundment, and other actions affecting water quality and the hydrologic regime amount to at least 16 sq mi annually. These losses represent a cumulative impact that seriously degrades the renewable resource base of the state and is of a magnitude that may attain material significance.

C. STRUCTURAL ALTERNATIVE 2: WIDENING OF BAYOU LAFOURCHE

1. General Description of the Alternative

This alternative would provide for widening of Bayou Lafourche from the Gulf of Mexico to the community of Larose where it intersects with the Gulf Intracoastal Waterway.

a) Objective of the Action

The objective of this alternative action is to provide for safer and more efficient navigation between the Gulf and the docking and service facilities along Bayou Lafourche that support the fisheries and offshore oil industry. Problems presently associated with navigation were described in Section 3, B, 1, a).

b) General Design

The project would require a channel 125 ft wide and 12 ft deep.

c) Site and Area Description

The project would only provide for the widened channel. Increased demand for services to the fishing and offshore oil industry would be accommodated through increased use or expansion of existing facilities in the communities along Bayou Lafourche.

See the first two paragraphs of Section 3, B, 1, c), "Site and Area Description" for a description of the Bayou Lafourche environment.

d) Existing Use and Environment Physically Affected

See Section 3, B, 1, d), "Existing Use and Environment Physically Affected".

2. Adverse Impacts

Construction of the widened channel would result in a major change in the environment. Many of the present service facilities are located immediately along and partially extend into the waterway. These facilities must be relocated. In many areas the road also follows the bankline and widening of the channel would necessitate relocation of the road and adjacent residences.

3. Beneficial Impacts

Construction of the widened channel would provide for safer and more efficient navigation from the Gulf to the docking and service facilities along Bayou Lafourche.

4. Decision on this Alternative

This alternative was rejected because of necessary relocations of facilities, residences, and roads, and the associated adverse cultural impacts. Due to the limited width of natural levee ridges along Bayou Lafourche, this action would also eliminate a large portion of the most suitable existing land for development on one or both sides of the bayou and would partially force development into adjacent wetlands that bound the natural levee ridges.

D. STRUCTURAL ALTERNATIVE 3: REDUCING THE SCOPE OF THE PROJECT

1. General Description of the Alternative

This alternative would involve reducing the total scope of the project with implementation of Phases 1 thru 5 only. Phases 1 thru 3, which have already been completed, include limited docking facilities, a warehouse, a marina, a boat launch, roads, utilities, and a stone jetty at Belle Pass. Phase 4, under consideration for the immediate future, would include dredging of the "T-Slip," preparation of 450 acres of spoil area for facility sites with ditches and drainage structures, bank stabilization, and dredging of the flotation canal and construction of additional bulkhead for docking. Phase 5, to be implemented as the development progresses and funding becomes available, would include the addition of a Police and Administration Building, a sewage system, and water mains and connections. Completion of Phases 1 thru 5 would provide complete multi-purpose facilities for steel-hulled shrimp boats, offshore survey and supply vessels, smaller fishing boats, crew boats, and pleasure craft.

a) Objective of the Action

The main objective of this alternative would be to reduce the ultimate size of the port and limit the kinds of activities that would be located there. The port would be limited to handling fishing boats, offshore service boats, and crew boats (including mineral extraction industry and LOOP related activities).

b) General Design

The facilities designs, site location, and impacts for Phases 1 thru 5 have been presented in Section 1, "Project Description" of this statement.

Under the project proper, the only facilities are the "T-slip" and adjacent sites, as described in Phases 1 thru 5 in Section 1, "Project Description."

c) Site and Area Description

This is treated under Section 1, A, of this report.

2. Adverse Impacts

Included in the two phases to be eliminated under this alternative (Phases 6 and 7) would be the dredging of Belle Pass to 30 ft x 500 ft, additional stone jetty improvements, and additional bulkheading. Failure to implement these phases would foreclose the option of larger ocean-going vessels and repair and/or fabrication of large offshore drilling rigs and platforms.

This alternative would limit the port's ability to respond to future needs of the offshore mineral extraction industry. It would also limit to a considerable extent the kinds and intensity of activities that would be conducted in the port area.

3. Beneficial Impacts

Restricting the channel depth and width would reduce the potential for saltwater intrusion and the rate of tidal exchange. This would have the beneficial effect of reducing marsh deterioration and erosion.

Physical effects on the environment, including streams and water bodies for Phases 1 thru 5 have been discussed in Sections 6, 7 and 8 of this statement. The direct and indirect effects of dredging related to the enlargement of Belle Pass including modification of benthic habitat, temporary reduction in water quality during construction, modification due to spoil disposal, and increases in saltwater intrusion and tidal exchange would be eliminated. In addition adverse effects on water and air quality related to activities such as offshore rig and fabrication yards would be eliminated.

4. Decision on this Alternative

The reason for rejecting this alternative is that it would foreclose options for responding to future needs of the offshore mineral extraction industry.

E. NON-STRUCTURAL ALTERNATIVE 1

1. General Description of the Alternative

By reducing the amount of offshore energy activity in this area the projected need for the port may be reduced. This could be partially accomplished by reducing the rate of offshore leasing in the Federally controlled areas of the continental shelf.

2. Impacts

This action would have the adverse impact of curtailing the national supply of oil and gas. It would also have major economic effects locally and regionally. This action would reduce traffic and product movement through the coastal zone with proportional reduction of associated primary and secondary impacts.

3. Decision on this Alternative

This alternative was rejected because it would not be feasible in view of present national energy needs.

F. NON-STRUCTURAL ALTERNATIVE 2

1. General Description of the Alternative

Use of expansion of other existing small port facilities in the region could be encouraged through legislative or financial measures.

2. Adverse Impacts

This action would have the adverse impact of increased boat traffic through waterways in environmentally sensitive areas of the coastal zone, as discussed under the "No Build" alternative. It would also have local adverse economic impacts. Induced expansion in areas of many existing ports would involve unmodified natural wetland areas. Greater distance and travel time to work sites would be required.

3. Beneficial Impacts

This action would have the benefit of concentrating expansion in the vicinity of existing development.

4. Decision on this Alternative

The location of the proposed port at the end of the transcoastal corridor and in proximity to the LOOP facility indicates that benefits outweigh adverse impacts.

SECTION 4: PROJECT DESIGN

A. ENGINEERING DESIGN

The Port Fourchon project is a multipurpose facility designed to serve as a port and industrial park. The port is to serve the offshore oil industry including the Louisiana Offshore Port (LOOP) for supertankers and Outer Continental Shelf drilling, to provide docking, unloading, and repair facilities for fishing boats, and to provide anchorage against Gulf storms other than hurricanes. Docking facilities will be in a "T" shaped slip dredged into the port's property (See Fig. 1-3 in Section 1). Spoil from the slip will be deposited in the southern one-third (450 acres) of an impounded area to create sites for industries related to fisheries and oil and gas exploration and development. Such industries may include seafood processing industries, fabrication yards for offshore drilling rigs, and boat repair yards. The engineering design to meet the Commission's plans is summarized below in seven phases.

The firms of Picciola and Associates, Inc., and J. Wayne Plaisance, Inc., under subcontract, conducted engineering investigations and studies involving fieldwork, drafting, and calculations necessary for the dredging and widening of Bayou Lafourche and Belle Pass, the calculation of the amount of filled material made available by these operations, the resulting elevations of the fill sites, and the estimated cost of these projects. The Division of Engineering Research, Louisiana State University (Whitehurst, 1974a) studied the Belle Pass area in relation to the proposed jetty system improvements and its effect on sediment deposition and erosion along the area's shoreline. The study was sponsored by a NASA grant and by the Lafourche Port and Harbor Commission grant for support of graduate students, 1974, and state funds from the Division of Engineering Research, Louisiana State University. The project phases are described below. Table 4-1 summarizes the cost and status of these separate phases.

Phase 1 - Phase 1 has already been completed by the Greater Lafourche Port Commission at a cost of $4.2 million. This phase consisted of the deepening and widening of Belle Pass to a channel 20 ft by 300 ft, west of the existing channel from Mile 0.76 in Bayou Lafourche to a 20 ft depth in the Gulf of Mexico, and of a flotation canal which links Bayou Lafourche with the commercial marina, making it accessible to large shrimp boats. During this phase the commercial marina (with a capacity of 68 large shrimp boats) was constructed, as well as a docking facility and warehouse on Bayou Lafourche, a water distribution system with a 300,000 gal elevated storage tank, and a five-ramp launch for sportscraft. Other projects included in this phase were the construction of levees for flood and hurricane protection, the extension of Highway 3090, and a bridge to provide access to the beach.

Table 4-1. Development program for Port Fourchon.

Phase		Description of Development	Cost	Status
1		Construction of docking facilities, warehouse, marina, boat launch, roads and utilities	$4,220,700	Existing
2		Stone jetty at Belle Pass	2,100,000	Existing
3		Roadway construction	498,000	Under construction
Proposed Federal Action				
4	A.	Dredging		
		(1) Proposed slip "c"		
		(2) Belle Pass		
		2,700,000 cu. yds. of material	1,600,000	Planned
	B.	Stone jetty improvements 60,000 tons of stones	2,000,000	Planned
	C.	Drainage improvements 450 acres with ditches and drainage structures	500,000	Planned
	D.	Flotation Canal		
		(1) Bank stabilization 4000 linear feet	175,000	Planned
		(2) Dredging 292,000 cu. yds. of material	175,000	Planned
	E.	Bulkhead for docking	800,000	Planned
		Total Phase 4 -	$5,250,000	
5	A.	Police and Administration building	181,000	Planned
	B.	Sewage system	812,500	Planned
	C.	Water mains and connections	206,250	Planned
		Total Phase 5 -	$1,199,750	
6	A.	Belle Pass dredging 30 X 500	4,000,000	Planned
	B.	Stone jetty improvements	2,000,000	Planned
		Total Phase 6 -	$6,000,000	
7		Additional Bulkheading	2,500,000	Planned
		TOTAL COST OF DEVELOPMENT -	$21,768,450	

Source: Greater Lafourche Port Commission, 1975.

Phase 2 - This phase, completed in 1975, consisted of the improvement of the small jetty at Belle Pass, extending it outward some 500 ft into the Gulf of Mexico. The jetty on the western side was extended a distance of 2100 ft from the existing shoreline (see Fig. 1-4). Work was completed at a cost of $2,100,000.

Phase 3 - Phase 3, under construction at the present time at a cost of $498,000, consists of a preliminary clam shell surface road that will allow easy access to future industrial and commercial development sites and to all port areas (Fig. 4-1, 4-2).

Phase 4 - The fourth phase of the development program, planned at a cost of $5,250,000, consists of:

a) Dredging a channel and slip and fill in Pass Fourchon left descending bank, at a point about 1.7 mi above the mouth of the waterway, approximately 8 mi southerly from Leeville, Louisiana, in Lafourche Parish; and relocating and maintaining an entrance channel at Belle Pass (20 ft x 300 ft). (Figs. 4-3, 4-4, 4-5).

b) Stone jetty improvements at Belle Pass (Bayou Lafourche). (Fig. 4-5)

c) Flotation canal

1) Bank stabilization (Fig. 4-6 and 4-7)

2) Dredging

d) Drainage improvements

e) Bulkhead for docking

Phase 4, parts a, b, c, d and e have been granted permits from the Corps of Engineers, New Orleans District, under Section 10 of the Rivers and Harbors Act of March 3, 1899 (U.S. Congress, 33 U.S.C. 403, 1899); and under Section 404 of the Federal Water Pollution Control Act (U.S. Congress, 86 Stat. 816, PL 92-500, 1972).

The dredging of the 20 ft x 400 ft slip (approximately 55 acres) will produce two million cu yds of sand for filling approximately 450 acres, thus providing suitable foundation for future industrial and commercial development. The fill material will be allowed to settle before any type of construction commences. Drainage improvements to the site so created will be undertaken during this phase, as part of its preparation for development. Swale ditches dug with a small dragline will be provided throughout the area.

Dredging will be primarily by hydraulic suction using heavy equipment for most additional work. The dredge material will be pumped into the area proposed to be filled, which is at present about 70% leveed

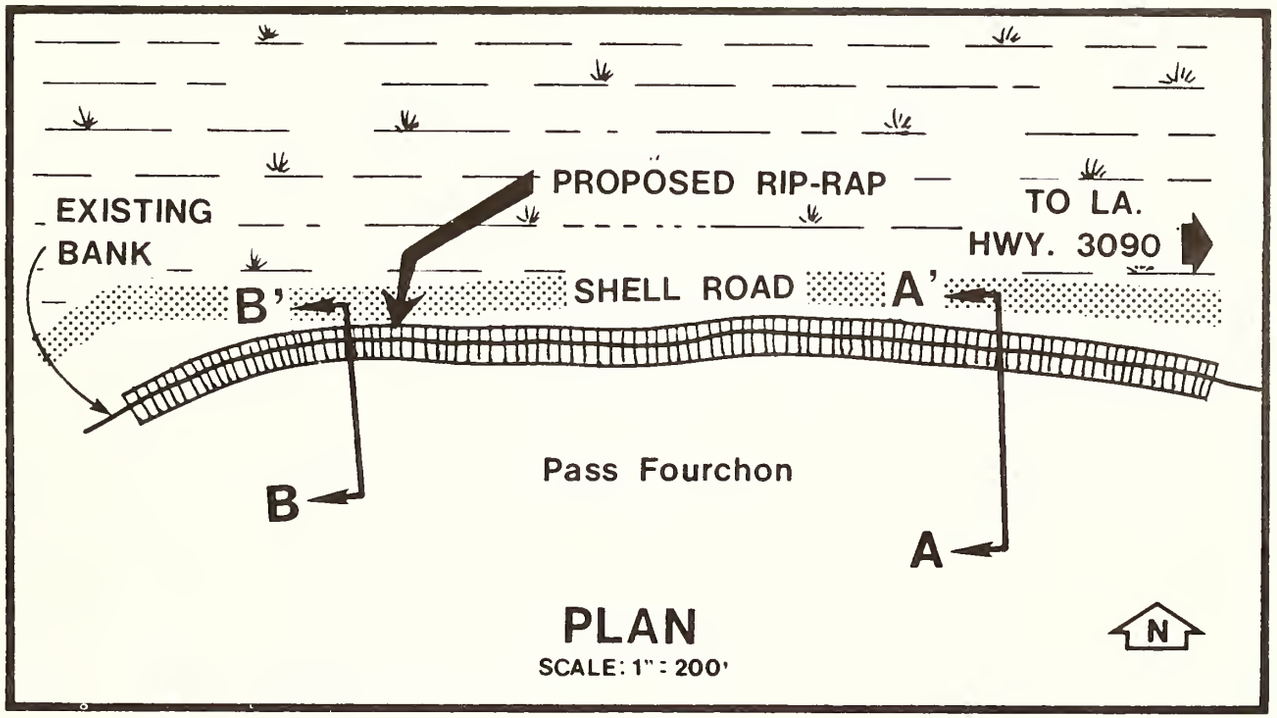


Fig. 4-1. Shell road and bank reshaping under construction at Port Fourchon.

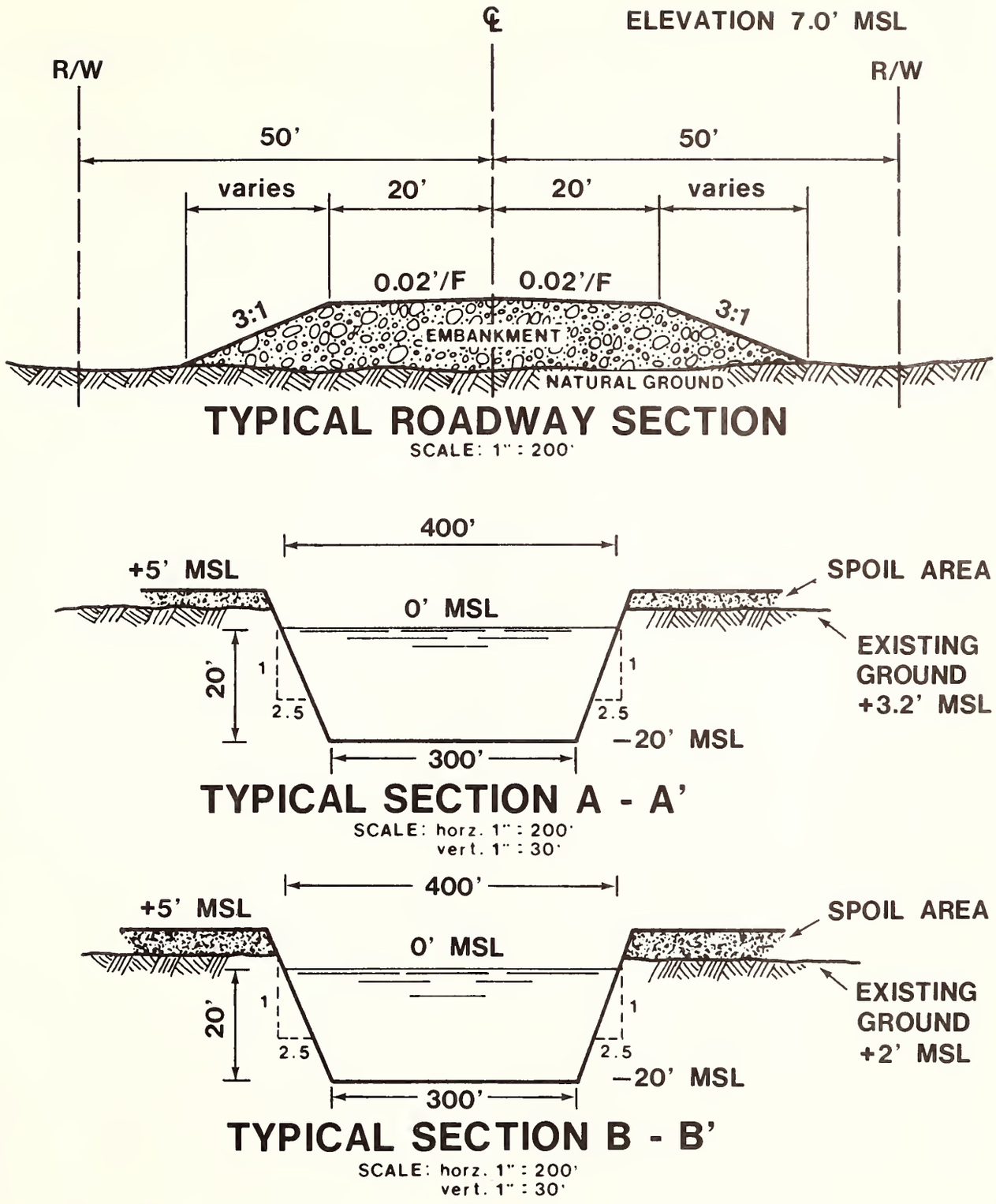


Fig. 4-2. Typical road cross sections at the Port Fourchon facility.

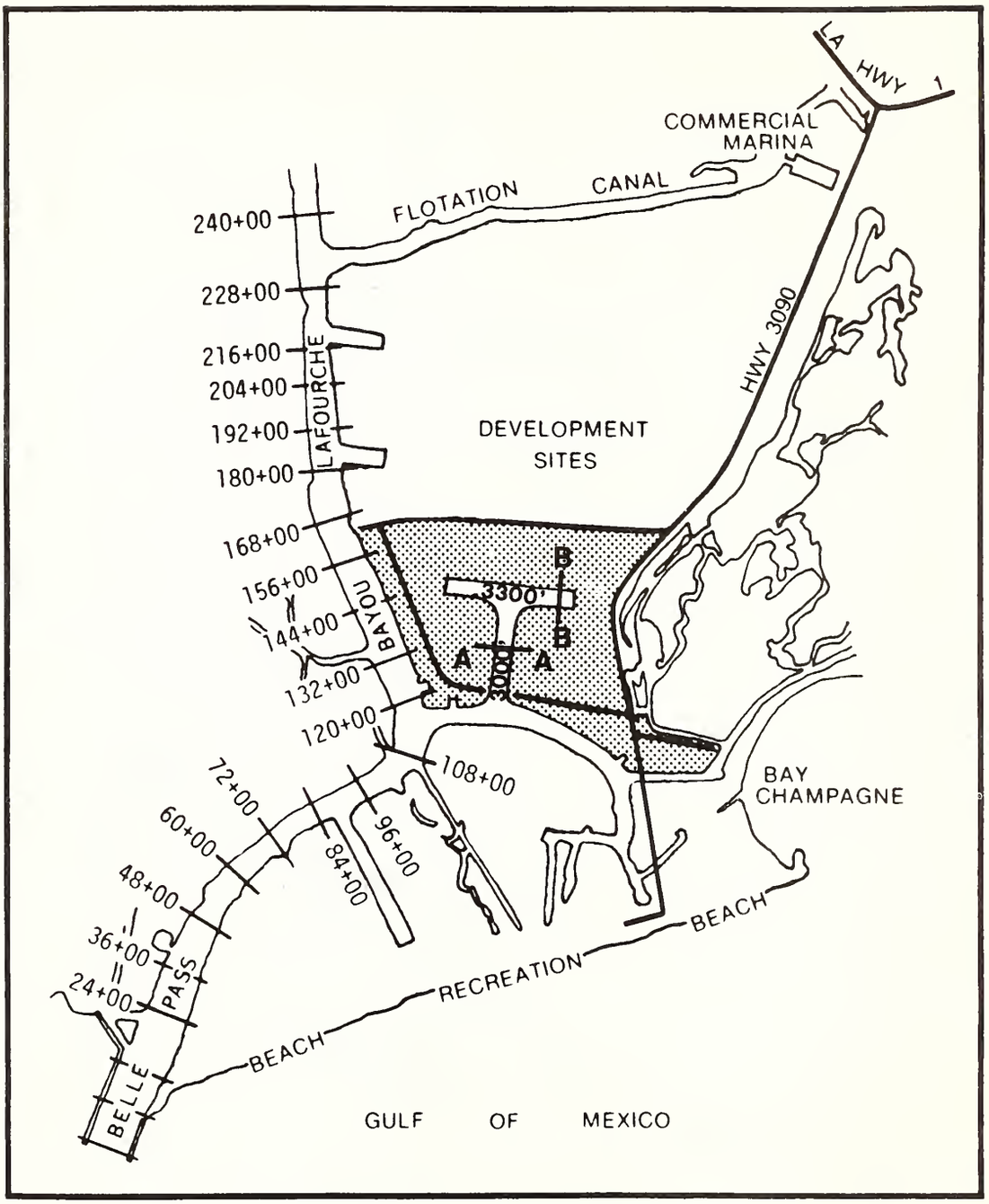


Fig. 4-3. Proposed channel and slip facilities at Port Fourchon.

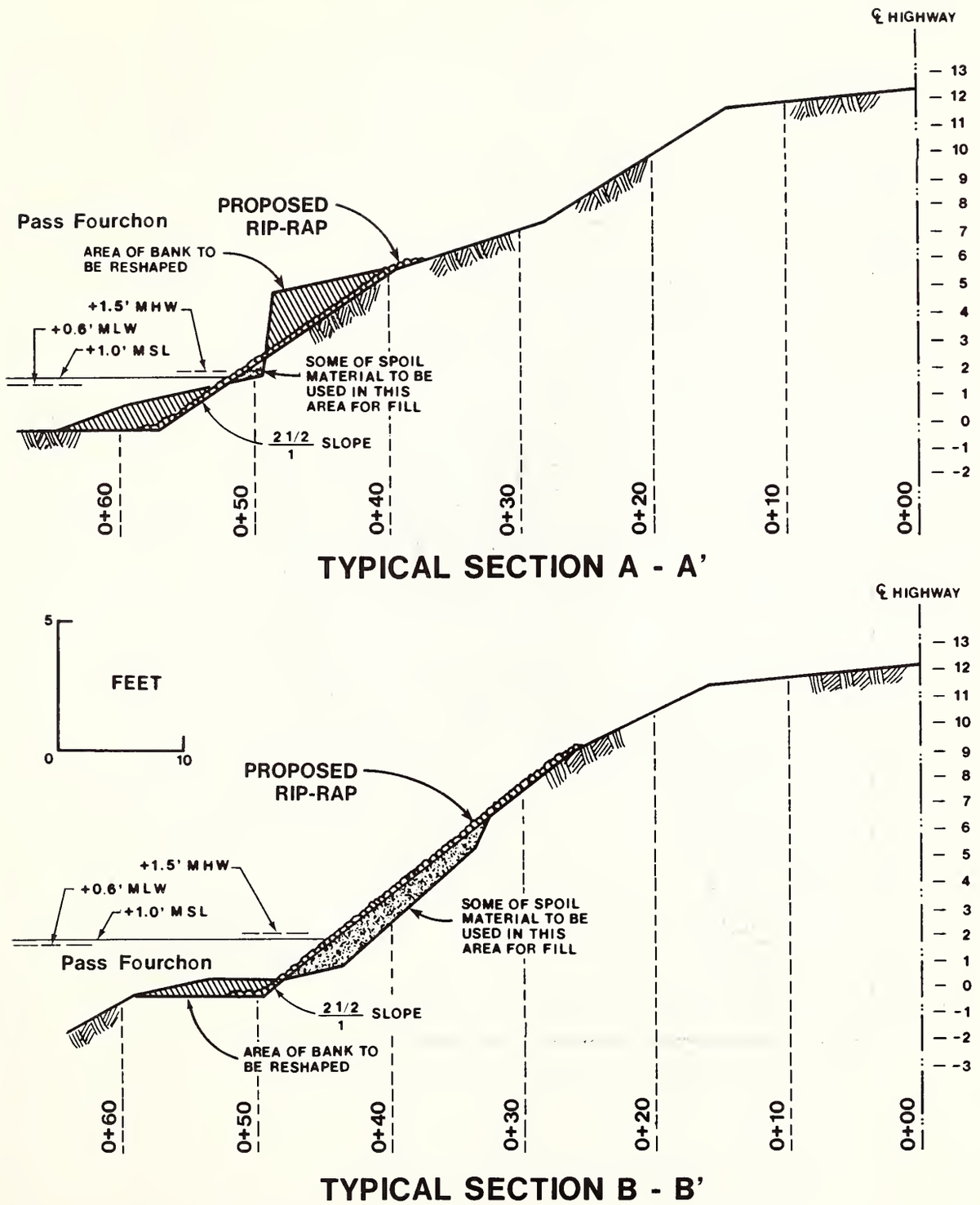


Fig. 4-4. Typical bank stabilization along Pass Fourchon at the Port Fourchon facility.

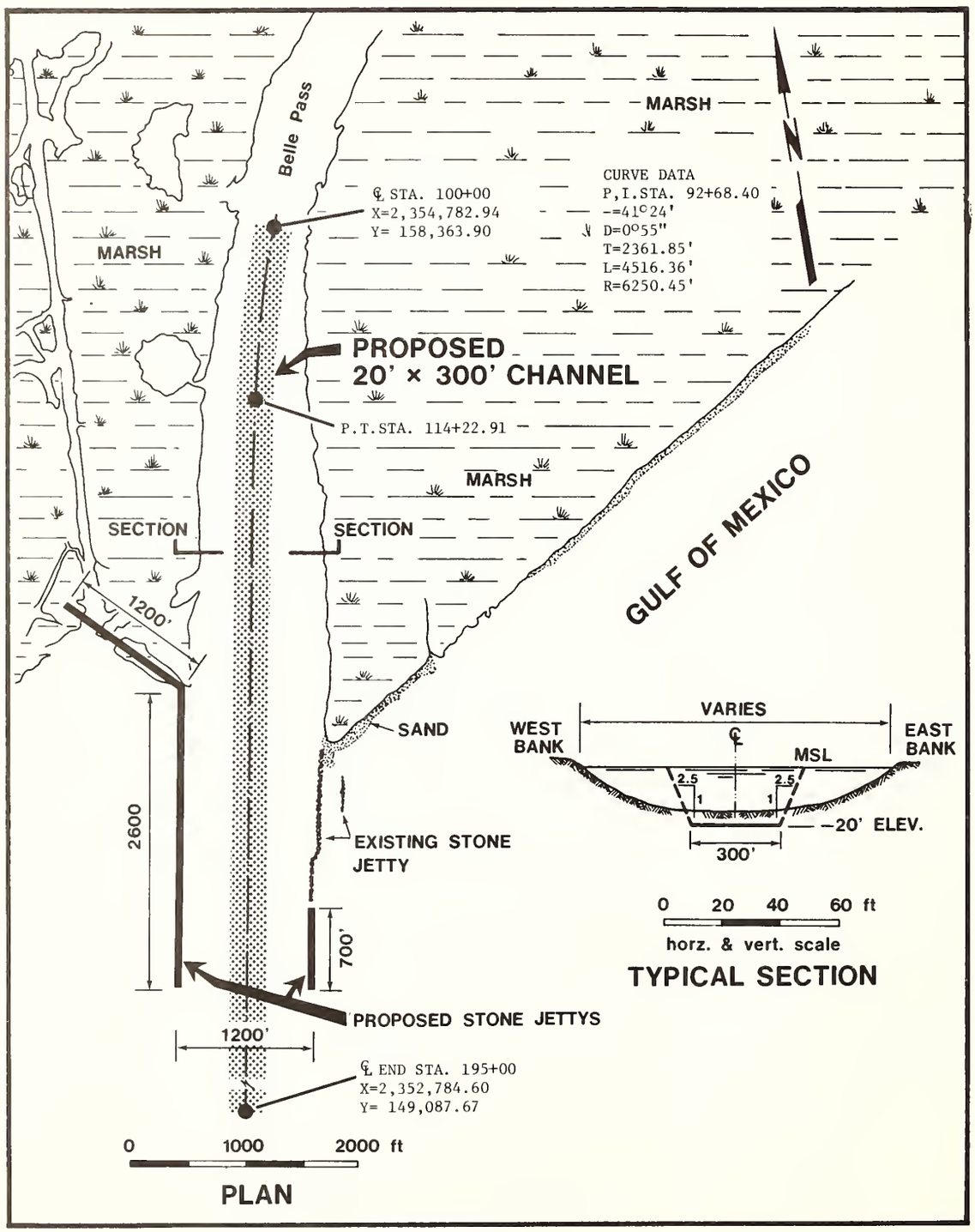


Fig. 4-5. Navigation channel improvements in Belle Pass and Gulf of Mexico associated with the Port Fourchon facility.

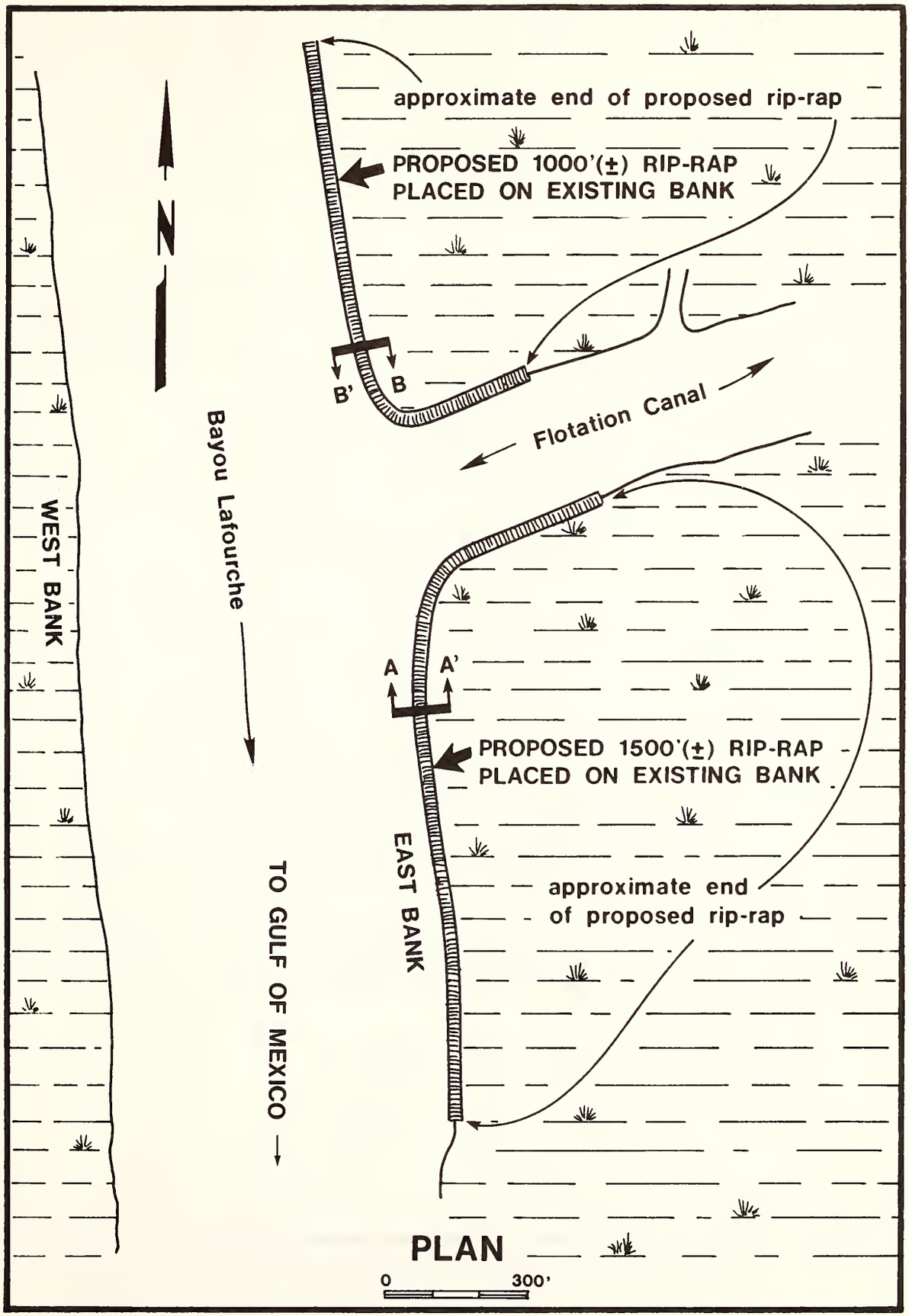


Fig. 4-6. Proposed rip-rap at intersection of Bayou Lafourche and the flotation canal at the Port Fourchon facility.

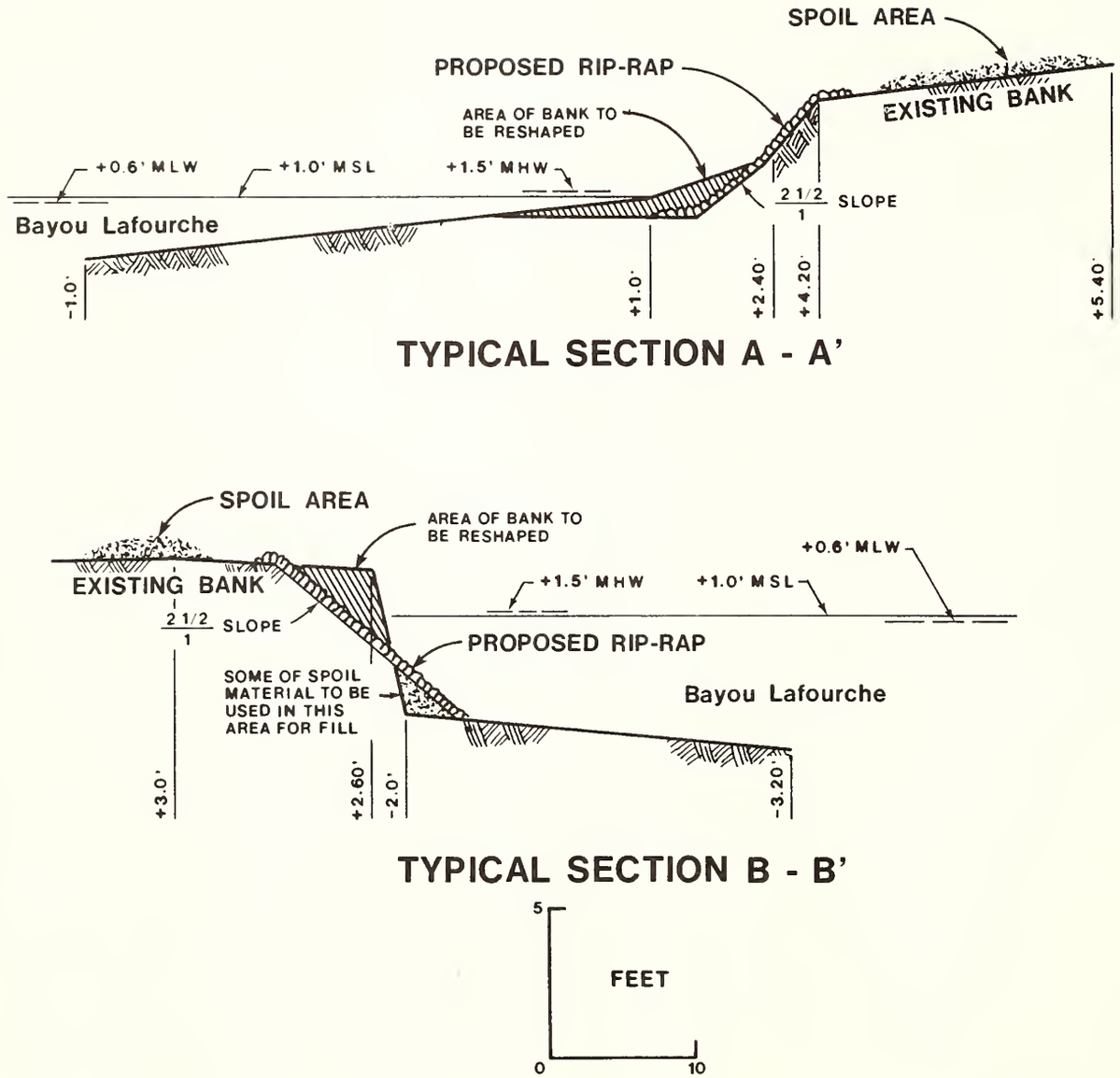


Fig. 4-7. Typical sections of proposed rip-rap at intersection of Bayou Lafourche and the flotation canal.

(levees were constructed at an earlier date), with a number of sluice gates to allow water to run out from the site.

Bulkheading along Pass Fourchon is planned during Phase 4, to aid the development of docking facilities and to prevent any further erosion or washing away of the existing bank. The work will consist of the back system with bumpers.

The stone jetty improvements will consist of adding stones over the top of the stone jetty to increase its height, plus extending the east and west jetty into the Gulf for a safer channel entrance and to prevent rapid shoaling.

The work at the flotation canal consists of placing rip-rap along each bank at its intersection with Bayou Lafourche and also on the south side of the Fourchon Road. Some of the existing bank will be reshaped as necessary for the placement of the rip-rap. The dredging operation will consist of removal of 330 cu yds of material to be deposited along with approximately 360 cu yds of rip-rap along the project site shoreline.

Phase 5 - Under phase 5 the Police and Administration building will be constructed. A 12-in water main with all necessary connections throughout the 450-acre development will be installed, and a sewage system will be built. This system will provide for extended aeration and tertiary treatment. Total cost of this phase will be $1,199,750.

Phase 6 - Belle Pass will be dredged to 30 x 500 ft and the stone jetty will be improved.

Phase 7 - Phase 7 consists of additional bulkheading as required to control erosional problems; the expected cost is 2,500,000.

Permits for Phases 5, 6, 7 have not yet been requested to the Corps of Engineers. Applications will be submitted in due time, before any construction work in these phases is undertaken.

B. ENVIRONMENTAL PROTECTION FEATURES FOR PROPOSED ACTION

The engineering design has taken into consideration the wetland environment in order to minimize any adverse impacts which may result from the project. The project is restricted to land which has previously been used as a spoil disposal area, with resultant loss of wetland habitat. Spoil will be deposited in a leveed, restricted area which will not allow suspended sediment to spread across the adjacent wetland system. The banks of the canals will be stabilized by bulkheading to prevent erosion by waves or runoff. Additional spoil will be dredged from the adjacent, heavily traveled waterways in order not to modify other wetlands.

C. ENVIRONMENTAL PROTECTION FEATURES FOR FUTURE PHASES

During Phase 5 of the project, a sewage system will be installed and will provide extended aeration and tertiary treatment. This will provide for minimal adverse effect of effluent on adjacent waters and wetlands.

In Phase 6, the stone jetty will be improved to reduce deterioration of the channel. In Phase 7, additional bulkheading will be installed to control bank erosion. By establishing a designated industrial zone, the port facility enhances centralization and industrial development and reduces chances of dispersion of such development through adjacent wetlands.

SECTION 5: COMPLIANCE WITH STATE AND LOCAL ENVIRONMENTAL PERMITS AND PROCEDURES

A. STATE PERMITTING PROCEDURES

1. Requirements

The State of Louisiana requires permits for a number of environmental factors that may be associated with construction of the Port Fourchon facility. These include: a) discharge into waters, b) emissions into the air, and c) waste facilities.

a) Discharge into Waters

If any type of activity will discharge waste into the state's waters, a report to the Louisiana Stream Control Commission is required before construction starts. The report is to describe the proposed disposal system and the measures which will be followed to mitigate pollution. Construction cannot start before a report has been submitted and granted a certificate of approval by the commission.

The report must contain: 1) a description of the proposed action, 2) location of the proposed action and exact location of the point of discharge, 3) volume and concentration of waste to be discharged, 4) description of waste treatment system to be installed, or measures that will be taken to prevent pollution of the waters to be affected, 5) estimated quality of improvement of the waste by the proposed treatment and measures that will be taken to control pollution, 6) an estimate of the rate of flow of the receiving waters, 7) an estimate of the alteration of the receiving water's quality by the proposed treatment work, and 8) any other data pertinent to understanding the proposed action. The report must be prepared and approved by a professional engineer duly licensed in Louisiana.

The Louisiana Department of Public Health is responsible for determining if the coliform content of wastes discharged is within their criteria of standards.

b) Emissions into the Air

If a facility will release matter into the air, a report must be submitted to the Louisiana Air Control Commission through the Louisiana State Board of Health. The report must be submitted before construction starts and should describe the proposed action and measures that will be taken to protect air quality. The proposed construction cannot be started before the report has been granted approval and a permit has been issued by the commission.

The report should contain; 1) a description of the proposed action, 2) location of the proposed action, 3) location of sources of the emissions, the size of their outlets, the rate and temperature of the emission, and the composition and description of the air contaminants being emitted, 4) description of measures for diminishing air pollution that will be utilized, or any other methods that will be used to prevent emission of undesirable levels of pollutants into the air, 5) estimates of how much emissions from the proposed action will alter the quality of the air, and 6) any other pertinent data for a good understanding of the proposed action. The report must be prepared and approved by a professional engineer duly licensed in Louisiana.

c) Waste Facilities

The Louisiana Health and Human Resources Administration requires permits for construction of water supply systems, sewage systems, and solid waste facilities that might be associated with the Port Fourchon facility. The permit applications for these items should include complete construction and operating plans and sufficient engineering data for project evaluation.

2. Status of Permits

The future phase waste treatment system has not been designed in detail so a permit has not been applied for. There are no major emissions into the air anticipated and so a report has not been filed. Permits for water supply, sewage systems, or solid waste facilities associated with the project have not been applied for. Prior to construction all required permits will be obtained and all applicable procedures followed.

In addition to permits, coordination with the agencies listed below usually takes place in a project of this type.

3. Coordination with State Agencies

Louisiana Department of Transportation and Development - This department is presently developing a coastal zone program. The Greater Lafourche Commission Development Program will be coordinated with state Coastal Zone Management goals.

Louisiana Department of Public Works - The department may be called upon to provide engineering services or advice and would be in a position to insure coordination with other projects they may have in the area.

Louisiana Wild Life and Fisheries Commission - The commission is concerned about any adverse effects the loss of the study area might have on fish and wildlife populations in both this area and in

adjacent areas. They strongly recommend that any activities in this area be coordinated with them. The Port Fourchon area is currently a research study area for the Wild Life and Fisheries Commission.

Louisiana Air Control Commission - There are not any special air quality studies in the immediate area being done by the commission. They have not held any public hearings because of violation of air quality standards by anyone in or near the study area.

B. LOCAL PERMITTING PROCEDURES

1. Requirements

The site is in the jurisdictional area of the South Central Planning and Development Commission, the South Lafourche Regional Planning Commission, and the Lafourche Parish Police Jury. The planning commissions serve as advisory and coordinating agencies. Powers of permitting rest with the Police Jury.

2. Relationship with Local Agencies

Contact with local agencies or governing bodies revealed the following project relationships:

South Central Planning and Development Commission - On their present "Land Use" map the Fourchon area is still represented as part of the Wisner Wildlife Management Area, which it was, until it was deleted from the map in October 1971. There is a study for a model zoning ordinance and map for Ward 10, Lafourche Parish (where the Port Fourchon development is located).

South Lafourche Regional Planning Commission - Their present zoning ordinance map of Ward 10, Lafourche Parish, where the Fourchon Area is located, is not presently in effect. According to Subdivision Regulations Ward 10, Lafourche Parish, Louisiana, every subdivision of land within the Parish of Lafourche excluding incorporated areas shall be shown on a plot, and submitted to the Commission having jurisdiction for review and recommendations and forwarded thereafter to the Police Jury for grant or disapproval.

Lafourche Parish Police Jury - At a regular meeting on November 9, 1977, the Lafourche Police Jury adopted a motion stating that no identifiable or potential conflict with any Jury regulations or proposed plans were found in the development plans for the Port Fourchon facility. (Parish of Lafourche Police Jury, 1977).

3. New or Additional Permits

Any new or additional permits or procedures that are developed prior to construction will be obtained or followed.

SECTION 6: ENVIRONMENTAL SUMMARY

A. ENVIRONMENTAL PROBLEMS WHICH CANNOT BE SOLVED

1. Land Constraints and Resources

The facility site is located in the low-lying coastal zone where flooding from storm surge, high velocity winds, and torrential rainfall occur in association with tropical cyclones and hurricanes. During the hurricane season (late May to early November), the average number of storms to cross this part of the Louisiana coast is 0.76/yr. Storm generated floods may attain depths of 10 ft or more in the project area.

The tract upon which the port site is located is surrounded by relatively fragile, estuarine areas that are high in biological productivity and are important from the standpoint of wildlife, fisheries, and recreation.

There will be a direct land loss of approximately 55 acres due to construction of the T-slip (Fig. 1-3). Approximately 450 acres of marsh and old spoil areas will be filled with spoil material and converted to industrial and commercial development. Some additional land will be lost due to bank erosion from wave wash caused by passing vessels.

2. Vegetative Resources

Areas to be elevated by dredge material to 3.3 - 4.2 ft will be transformed from a wetland habitat to a terrestrial area. The marsh species (especially Spartina alterniflora and Avicennia nitida) will be unavoidably and permanently lost from this site. Spoil-associated species will be killed at the time and place of spoil deposition but will regenerate once deposition ceases. Construction of roads, parking lots, camp sites, and industrial areas will destroy any pre-existing or emerging vegetation within the planned Port Fourchon facility.

Camping and recreation facilities near the beach will, in all probability, destroy the present beach vegetation. This will occur directly, through clearing, or indirectly, through trampling by heavy tourist utilization of the area.

Areas behind the beach which are also scheduled for recreation may eventually lose their existing vegetation either directly or as a secondary consequence of vegetation destruction along the beach front. Dune vegetation is noted for serving as a first line of defense against wind and wave erosion and once removed, the coastal erosion processes can proceed farther inland. This kills the interior vegetation by land erosion or saltwater intrusion. These processes will be especially effective against the present and projected terrestrial vegetation which will occupy the higher spoil elevations required for the development plan.

3. Wildlife Resources

Spoil coverage of the 450 acres to be developed will result in a temporary loss of existing vegetated spoil bank habitat for rabbits, small birds, and other animals which may occasionally utilize these areas as a habitat. Revegetation of newly deposited spoil will occur quickly, however, and spoil covered areas will have returned essentially to previous conditions as far as vegetation is concerned within one to two years after spoil is deposited.

Construction of roads, buildings, warehouses, and other structures will permanently remove an area of spoil bank habitat over which they will be erected. The general quality of spoil banks as wildlife habitats will be reduced by the presence of structures, since activities of man and wildlife usage of an area are partly incompatible. However, spoil banks are not prime habitat and are less ecologically important than marsh habitats.

Some parts of the site, especially the Gulf shore, nearshore Gulf areas, and the rock jetties at the mouth of Belle Pass, are used by the brown pelican, Pelecanus occidentalis, an endangered species, as feeding areas. Although this species would be the most affected by the project, the area also serves as a habitat for two other endangered species, the bald eagle (Haliaeetus leucocephalus) and the peregrine falcon (Falco peregrinus) (Aycock, 1976).

4. Water Resources

Turbidity increases due to the dredging and spoil placement will temporarily affect the water quality of Bayou Lafourche and/or the remaining brackish water environment within the impounded area. Probable but yet undetermined pollutional impacts will result from the dredging itself and runoff from the disposal area. Dredging will modify the water bottom of Bayou Lafourche and the flotation canal. Salinity increase in Bayou Lafourche is unavoidable but salinity increase of adjacent marsh environments could be ameliorated by restricting water exchange through the limited number of tidal streams that connect Lower Bayou Lafourche and Timbalier Bay.

There will undoubtedly be some water pollution derived from boat traffic, minor spills or bilge-pumping, or from industries to be located at the port. There is no way to assess the degree or nature of water pollution from these sources during the pre-project period, except to say that potential water pollution is likely to be of a minor nature, since pollution regulations will be enforced. Water quality standards of the State of Louisiana will be adhered to.

5. Aquatic Resources

Adverse effects on aquatic resources will occur during dredging operations, consisting of destruction of benthic invertebrates living in the bottom muds of areas to be dredged and temporary turbidity increases caused by dredging which may affect primary aquatic production

for a short period. The areas to be dredged include a channel extending into the Gulf of Mexico from the Belle Pass jetties to the 30 ft contour line, Belle Pass, Bayou Lafourche as far north as the flotation canal, the flotation canal itself, and a T-slip north of Pass Fourchon.

These losses are only temporary, however, Dredged areas will be recolonized by bottom-dwelling invertebrates after dredging operations are completed. Any decrease in primary aquatic production caused by increased turbidities during dredging operations will be very short-term.

6. Economic and Social Impacts (Primary and Secondary)

Summary of Population Projections - Population projections for the lower Lafourche Parish, and especially for Ward 10 where the proposed facilities are located, are difficult to assess, since it will depend to a great extent on such factors as construction of the Superport off the coast of Bayou Lafourche and development of the Port Fourchon facility. It is expected that since there exists almost total employment in the parish, all direct employment will cause workers to migrate into the parish (Gulf South Research Institute, 1974).

Future Economic Activity and Land Use - Loss of 450 acres of spoil and marsh previously devoted to recreation, sport fishing, and hunting will cause some monetary loss to the local economy, which would be an unavoidable adverse environmental impact. Beneficial effects are discussed at full length under Section 2,C of this report.

7. Recreational Resources

The loss of 450 acres of recreational land to industrial and commercial uses would be an adverse environmental effect which cannot be avoided if the proposed project is implemented. However, additional recreational land would be made accessible within the 3,800 acres at Port Fourchon, including a large segment of sand beach. For additional recreational benefits, see Section 6, B, 3 below.

8. Archeological Resources

Of the nine prehistoric archeological sites in the area, six could be adversely impacted by primary effects of the project (Table 6-1). Included are sites 16 LF 7, 16 LF 82, 16 LF 83, 16 LF 84, 16 LF 85, and 16 LF 86, all of which could be covered by maintenance dredging spoil (Table 6-2). Of these, sites 16 LF 82 and 16 LF 86 are considered to be eligible for nomination to the National Register of Historic Places. The remaining four are classed as slightly to moderately important; all have some potential for yielding additional scientific data that would contribute to a better understanding of the cultural history, cultural processes, and paleoecology of the area.

Table 6-1. Adverse effects to archeological sites of the area.

Site	None	PRIMARY		SECONDARY	
		To Be Totally Buried By Spoil Deposits	To Be Covered By Future Spoil Deposits From Maintenance Dredging	Increased Erosion Due To Increased Boat Traffic	Vandalism Due To Increased Numbers of Tourists and Boaters
16 LF 7		X			
16 LF 8	X				
16 LF 9	X				
16 LF 34	X				
16 LF 82			X	X	X
16 LF 83			X	X	X
16 LF 84			X		
16 LF 85			X	X	X
16 LF 86		X			X

Source: Cultural Resources Survey by Coastal Environments, Inc., 1977.

Table 6-2. Degree of importance each archeological site should receive.

SITES	NOT IMPORTANT Site Almost Totally Destroyed	SLIGHTLY IMPORTANT Some Data May Be Obtained by Surface Collections	MODERATELY IMPORTANT Systematic Collection Should Reveal Beneficial Data	HIGHLY IMPORTANT Site Still has *in situ* material and/or High Potential For Spatial Analysis of Artifacts
16 LF 7	X			
16 LF 8	X			
16 LF 9	X			
16 LF 34	X			
16 LF 82				X
16 LF 83			X	
16 LF 84		X		
16 LF 85		X		
16 LF 86				X

Source: Cultural Resources Survey by Coastal Environments, Inc., 1977.

Spoil coverage can be avoided during maintenance dredging at each of the sites. This will be accomplished by having the extent of the sites identified by a qualified archeologist and excluding the sites from the spoil areas.

Sites 16 LF 82, 16 LF 83, 16 LF 85 and 16 LF 86 will also be subjected to secondary impacts from the project in the form of accelerated erosion due to increased boat traffic and vandalism due to greater frequency of tourists and boaters. While these impacts are largely unavoidable, a mitigation plan has been proposed and is discussed in section 6, B, 2.

9. Agricultural Resources

There are no agricultural lands in the study area, consequently, none will be affected adversely by the proposed port facilities.

10. Mineral Resources

No mineral resources will be unavoidably and adversely affected by the proposed action, since none of the existing hydrocarbon wells in the Fourchon area are presently under production. Development of the port will not preclude further oil exploration and production.

11. Existing Developments

None of the existing developments, which are part of Phases 1 and 2 of the overall Port Fourchon development program, nor the Bay Marchand tank facilities, would be adversely affected in any mannner which cannot be avoided by the proposed action.

12. Human Element

The probable migration of people into the parish as a result of job opportunities created by the new port facilities would be an unavoidable effect. This would be considered an adverse impact only if it would create additional demands for urban developments and services to an extent which cannot be feasibly met on land suitable for urban use.

B. MITIGATION

Three areas which require mitigation have been identified during the course of the environmental assessment of the Port Fourchon project. The following recommendations have been made to reduce the adverse effects of port development.

1. Fish and Wildlife

Representatives of the U.S. Fish and Wildlife Service have indicated that a management program is needed for the 2,284 acre impounded wetland area lying north of the proposed port development area (Fig. 1-3, area B). A fish and wildlife management plan, involving both structural measures for water control and non-structural administrative measures, will be developed and implemented for this area of the Port Commission property in consultation with representatives of the U.S. Fish and Wildlife Service.

2. Archeology

The archeological study conducted in conjunction with the assessment resulted in specific recommendations for management of the cultural resources in the project area. The first recommendation was avoidance. A qualified archeologist is to delineate fully the extent of sites within or close to spoil disposal areas. The site areas are to be excluded from the spoil disposal and protected from any equipment movement associated with dredging or construction.

As the sites are subject to continuing erosion, they are to be periodically monitored and collected. Additional evaluation and data collection should also be made through test excavations, with emphasis on the two sites considered to be eligible for nomination to the National Register of Historic Places.

The program is to be conducted by a qualified archeologist in consultation with the office of the secretary of the Louisiana Department of Culture, Recreation, and Tourism (the State Historic Preservation Officer).

3. Recreation

Under Phase 1 of the Port facility plan, a road and bridge were constructed, which provided automobile access to the Gulf beach area of the Port Commission tract. This road has opened a new area to the public for outdoor recreation activities such as crabbing, fishing, camping, and hiking along the beach.

The Port Commission has also constructed a public boat launch for small boats which provides access to Pass Fourchon, Bay Champagne, and other waterways.

The Nicholls State University Laboratory is located on the Port Commission tract and has an ongoing program of coastal and marine research. Wetlands and waterways on and adjacent to the Port Commission tract are utilized as study areas.

SECTION 7: SHORT-TERM AND LONG-TERM IMPACTS OF THE PROJECT

Short-term uses of the environment are those actions taken by man which are finite in terms of time, but may require irretrievable commitments of resources. For example, an oil refinery will no longer be useful when the nonrenewable mineral resource is depleted, but forests or wetlands on which it is constructed cannot be restored to their previous level of productivity. Maintenance and enhancement of long-term productivity refers to sustaining the yield of renewable resources, such as fishery production and harvest.

A. LAND RESOURCES

The area on the northern portion of the property between Bayou Lafourche and LA Highway 3090 has already been altered, and is presently surrounded by levees, thus it is no longer acting as an important nursery area for commercial or sport fisheries because there is insufficient water exchange between the bayou and the diked area. However, as a result of its being leveed, salinity has decreased and the area now serves as a temporary feeding ground for migratory waterfowl, shorebirds, wading birds, and white pelicans. Part of this habitat will be lost when covered with dredge material from work in Bayou Lafourche, the Flotation Canal, and construction of the projected T-slip.

B. VEGETATIVE RESOURCES

An immediate impact of constructing port facilities will be the destruction of pre-existing vegetation, both terrestrial and wetland. While a limited amount of vegetation will invade undeveloped areas, the productivity of the vegetative resources will be severely reduced. Even areas such as the beach and some interior marshes that are alloted for recreation are likely to deteriorate due to alteration of environmental conditions (especially the hydrologic regime and low elevation) that favored their development.

Louisiana marshlands, especially the Spartina alterniflora marshes, are noted for extremely high productivity rates (Day, Smith, Wagner, and Stone, 1973), and are credited with creating the "fertile fisheries cresent" in the Gulf of Mexico (Gunter, 1967). The indigenous vegetation characterized by low diversity and high productivity is extremely well adapted to the dynamic environment existing in the coastal zone (Walker, 1973) and can exist there over long periods of time. Replacement of this natural marsh by an unnatural terrestrial environment or by open water (canals and slips) significantly reduces productivity (Day, Smith, Wagner, and Stone, 1973). Because this is an area undergoing subsidence, erosion, and relatively frequent storm surges, the predicted terrestrial vegetation or bare habitats will not be as well suited to withstanding the aforementioned coastal processes and the rate of land loss may be expected to intensify.

C. WILDLIFE RESOURCES

The environmental impacts of the project on terrestrial wildlife resources will be minimal for developments on spoil banks which are less important wildlife habitats than nearby ecologically important marsh habitats. The port facility is not viewed as a "short-term use of man's environment," but rather as a long-term use, since the port is expected to provide a facility for the use of the various industries it will serve, both immediately upon completion and in the future. Construction of the port will cause short-term impacts on wildlife habitats. The long-term productivity of marsh habitats near the port site will be reduced by the increase in salinity resulting from waterway modifications.

D. WATER RESOURCES

Long-term productivity of Louisiana's marshes and related water bodies hinges on a large number of interrelated processes. As a result, in part, of human interference with these processes, one of the most detrimental trends has been saltwater intrusion. The present project will further contribute to this trend as a result of channel enlargement of lower Bayou Lafourche. A resulting increase in salinity will further contribute to a trend that adversely affects the long-term productivity of the Mississippi deltaic plain which includes wetlands in the project area.

E. AQUATIC RESOURCES

Environmental effects of project construction on aquatic resources are in most cases only temporary effects associated with dredging. Construction and operation of the port facility will not affect Belle Pass and Bayou Lafourche in their function as a passageway for marine organisms between the Gulf of Mexico and inshore estuarine areas. Changes in the volume of water exchanged between Bayou Lafourche and nearby marsh-estuarine nursery areas should not be affected, though the change in water salinity may affect nursery areas.

Water pollution will likely be a persistent problem as could be expected in any port operation. Pollution levels will be closely monitored, however, and pollution regulations will be strictly enforced.

F. AIR IMPACTS

Temporary air impacts such as noise, dust particles, and emissions of construction equipment during construction phases should not be regarded as having any adverse effects on the long-term productivity of the environment. Air impacts from the operation of the facility, such as emissions from industries that might locate in the area, could possibly have adverse effects on the long-term productivity of the area's environment if industries do not comply with the regulations established for maintaining the purity of air resources by Federal, state, and local government agencies.

G. ECONOMIC AND SOCIAL IMPACTS

Long-term economic productivity of the area could only be endangered if the principal renewable resources of the area and of adjacent areas such as fisheries, marsh productivity, and recreation are adversely affected by construction and/or operation of the Port Fourchon facilities.

Any increased traffic on the waterways resulting from port operations would probably result in lower water quality in the area. Uncontrolled pollution by vessels in the port and pollution from oil, garbage, sewage, and industrial wastes, if not properly controlled, could have adverse environmental effects on productive marsh areas adjacent to the port.

Beneficial economic and social impacts derived from operation of the Port Fourchon facilities are fully covered in section 2, A of this report.

H. RECREATIONAL FACILITIES

Filling of the 450 acres within the diked areas on the upper part of the study area, which now serves as habitat for many fur-bearing mammals and for migratory waterfowl, would adversely affect the long-term productivity of this area's recreational resources. Lower water quality of the area due to increased vessel traffic in the waterways, air pollution, and diminishing aesthetic qualities from port activities and industrial developments would also have an adverse effect in the long-term recreational opportunities of the study area and adjacent areas. Beneficial recreational impacts have been covered in section 6, B, 3 of this report.

I. ARCHEOLOGICAL RESOURCES

As described previously, six of the nine prehistoric archeological sites in the area could be adversely affected by dredging, bankline erosion, and/or vandalism. Two of these sites are eligible for nomination to the National Register of Historic Places. A mitigation plan including avoidance of significant sites and further evaluation and study of sites endangered by erosion, vandalism and future spoil disposal has been developed. (See section 6, B.)

J. HUMAN ELEMENT

Migration of people into the area to fill newly created jobs as a result of the Port Fourchon facilities construction and operation can be viewed as a long-term induced effect. Pollution caused by this migration such as sewage disposal, increased energy consumption demand, urban sprawl into the wetlands, and other directly and indirectly related problems could adversely affect the long-term productivity of marsh and estuarine areas adjacent to the Port facilities if not properly controlled.

SECTION 8: IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A. LAND RESOURCES

The 450 acres which will be filled with spoil material from the dredging operations of the proposed T-slip represent an irreversible and irretrievable commitment of land resources to industrial development. Also, the designated spoil areas along both sides of Bayou Lafourche, along the Flotation Canal, and at Belle Pass will be irreversibly and irretrievably committed to this use.

B. VEGETATIVE RESOURCES

Implementation of the port development plan calls for dredging of a T-slip, and filling of wetlands, spoil deposits, and natural levee sites to elevations of 3.3 or 4.2 ft above mean gulf level (mgl) . The dredging of canals and slips will result in irreversible and irretrievable loss of wetland and terrestrial vegetation and its accompanying high productivity (Day, Smith, Wagner, Stone, 1973). If these water bodies are not bulkheaded for protection against continual erosion, the vegetation adjacent to these features will also be lost in time (Whitehurst, 1974a).

Filling for road and industrial and commercial construction and tourist and camping facilities will eliminate pre-existing wetland, aquatic, or terrestrial vegetation. If action is taken to secure these areas from erosion, subsidence, and saltwater intrusion, the loss of wetland (marsh) vegetation will be irreversible and irretrievable. If such protection is not ongoing, portions of the region may return to wetlands because Mangroves and Spartina alterniflora have the ability to colonize unvegetated, intertidal lowlands and salt flats (Penfound and Hathaway, 1938; Walker, 1973).

Other areas within the port facilities that are significantly elevated to support terrestrial vegetation will resume pre-development conditions if construction and maintenance for industrial use is not undertaken.

C. WILDLIFE RESOURCES

The only resource loss which can be considered as permanent, as far as terrestrial wildlife resources are concerned, will be the amount of spoil bank habitat lost by being paved over during road or building foundation construction. As previously noted, spoil bank habitats are less valuable or less critical habitats than marshes, the other terrestrial habitat areas occurring in the project area. The loss of the spoil bank habitat area can be considered to be of minor importance involving no great loss of resources.

D. WATER RESOURCES

Incremental increases in salinity levels as a consequence of enlargement of the channel of lower Bayou Lafourche will contribute to the present trend of saltwater intrusion adversely affecting the productivity of the Mississippi deltaic plain which includes wetlands and estuaries in the project area.

E. AQUATIC RESOURCES

Aquatic resources will be committed to the extent that increased salinity reduces productivity of the nursery areas in the wetlands and estuaries adjacent to Bayou Lafourche.

F. RECREATIONAL RESOURCES

The 450 acres that will be committed to industrial and commercial development will result in the elimination of this acreage of land for recreational uses such as birdwatching, hunting, fishing, and commercial trapping. Aesthetic changes in the area due to its commitment to industrial uses will represent an irreversible and irretrievable loss to the natural and unique landscape of the area that will diminish the quality of the recreational experiences.

G. ARCHEOLOGICAL RESOURCES

Direct adverse impacts on prehistoric sites within or near designated spoil disposal sites will be overcome through avoidance; maintenance dredging could affect some of these sites. Secondary impacts resulting from increased bank erosion and vandalism will occur at sites 16 LF 82, 16 LF 83, 16 LF 85, and 16 LF 86. This loss will be partially reduced through systematic archeological testing and evaluation.

H. AGRICULTURAL RESOURCES

Not applicable.

I. MINERAL RESOURCES

There will not be any irreversible or irretrievable commitments of mineral resources which would be involved in the proposed action should it be implemented.

J. EXISTING DEVELOPMEMTS

Maintenance of the existing developments which are part of the total Port Fourchon development program and the Bay Marchand facility represent an irreversible and irretrievable commitment of resources in construction materials, labor, and fuel utilized for this purpose.

K. HUMAN ELEMENT

Probable migration of people into the area as a result of newly created jobs associated with the port development, which would increase demands on more service facilities and energy consumption, is likely to represent an irreversible and irretrievable commitment of resources.

L. MISCELLANEOUS

Industrialization induced by the development of the Port Fourchon Facilities and the maintenance of these facilities in operation will represent a continuous commitment of resources irreversibly and irretrievably.

SECTION 9: FEDERAL AND STATE INVOLVEMENT

A. FEDERAL PROJECTS

The major Federal agency involved in activities similar to those at the proposed port is the U.S. Army Corps of Engineers.

Over the years, Bayou Lafourche has been widened and deepened and new channels have been dredged at Belle Pass to meet the needs of established and projected navigation. The following is an account of the Corps of Engineers, New Orleans District, activities in relation to Bayou Lafourche and the Port Fourchon area at Belle Pass.

The River and Harbor Act of 30 August 1935 House Document 45, 73rd Congress, 1st Session, provides for a permanent closure of Bayou Lafourche without lock at Donaldsonville, Louisiana, the junction of Bayou Lafourche and the Mississippi River; a channel 6 ft by 60 ft from Napoleonville to Lockport; a channel 6 ft by 60 ft from Larose to the Gulf of Mexico with a jettied entrance at Belle Pass and the closure of Pass Fourchon.

Dredging between Larose and the Gulf of Mexico and the jetties at Belle Pass was completed in 1934. A modification of the existing project providing for an auxiliary channel 12 ft by 125 ft from the Intracoastal Waterway generally parallel to, and west of, Bayou Lafourche along Grand Bayou Blue to Bayou Lafourche below the highway bridge at Leeville, thence in the bayou to the 12 ft depth contour in the Gulf of Mexico; a channel 9 ft by 100 ft in Bayou Lafourche from Leeville to the lower limits of Golden Meadow, restoring and extending the existing jetties at Belle Pass from the 6 ft to the 12 ft depth if found advisable to reduce maintenance; and dredging a 12 ft by 125 ft channel from Bayou Lafourche at Leeville through the southwestern Louisiana Canal to and through Bayou Rigaud (Grand Isle) was authorized by the River and Harbor Act of 14 July 1960, House Document 112, 86th Congress, 1st Session. The reach of Bayou Lafourche between Thibodaux and the head of the bayou at Donaldsonville, authorized by Act of 30 August 1935, has been deauthorized under Public Law 90-140, approved 22 November 1967.

Dredging between Lockport and Larose was completed to 9 ft by 100 ft dimensions in 1936 as part of the Gulf Intracoastal Waterway. Dredging between Lockport and Thibodaux, Louisiana, is in inactive status due to lack of rights-of-way and spoil areas.

Dredging authorized by the Act of 14 July 1960 between Mile -0.3 and Mile 13.2 on Bayou Lafourche was completed 11 September 1963.

Dredging Bayou Lafourche from Leeville to Golden Meadow (9 ft by 100 ft) was initiated on June 21, 1966, and completed in August 1966.

Dredging of Lafourche auxiliary channel will be initiated contingent upon availability of rights-of-way and funds.

The Greater Lafourche Port Commission requested from the Corps of Engineers, and was granted, a permit to dredge a new channel 20 ft by 300 ft wide west of the existing channel from Mile 0.76 in Bayou Lafourche to the 20 ft depth in the Gulf, and to close the existing jettied channel after completion of the new channel. This work was completed in March 1968 and the Port Commission must maintain the channel at no less than 12 ft by 125 ft.

B. STATE PROJECTS

The major state agency involved in activities similar to those at the proposed port is the Louisiana Department of Public Works. Their involvement is as follows.

The department has provided engineering services for 2 projects in the vicinity of the area for which construction is complete. These projects were for the construction of a timber bulkhead at the location of the Port Fourchon Marine Laboratory. This bulkhead and an extension were constructed in 1973 and 1974 for Nicholls State University, Thibodaux, Louisiana. The modifications to the Belle Pass jetties have been accomplished with public funds; however, the Port Commission handled these contracts.

The State Clearinghouse has processed the Standard Form 424 for A-95 review of the proposed project and recommended funding of the project (Department of Urban and Community Affairs, 1977).

Comments were requested from:

- Teche Regional Clearinghouse
- State Planning Office
- Art, Historical and Cultural Preservation Agency
- State Soil and Water Conservation Committee
- Governor's Council on Environmental Quality
- Department of Commerce

Approval or support for the project was received from:

- Teche Regional Clearinghouse Review Board (September 7, 1977)
- South Central Planning and Development Commission (August 29, 1977)
- State of Louisiana, Department of Commerce (August 2, 1977)
- State of Louisiana, Governor's Council on Environmental Quality (August 1, 1977)

No adverse comments were received. The State Clearingouse considers no comment from an agency as a sign of no objection to a project.

C. OTHER AGENCIES CONTACTED

A list of all agencies contacted at the Federal, state, and local levels of government are included in Section 10. These agencies are not participating directly in the project but do serve in advisory and review capacities.

D. COMMENTS RECEIVED

Significant agency comments received that are related to the environmental aspects of the project are as follows:

1. U.S. Army Corps of Engineers (12 February 1976)

The water quality-sediment requirements of the EIS in order to fulfill Corps of Engineer regulations promulgated under Section 404 of the Federal Water Pollution Control Act of 1972 were delineated. Recommended sample locations for sediment and water were given. The analysis to be performed on each sample was given (U.S Army Corps of Engineers, 1976).

2. U.S. Department of Interior, Fish and Wildlife Service (8 March 1976)

The Fish and Wildlife Service has made substantial environmental comment on the project. Exerpts from their review best state their environmental impact analysis.

"Completion of the proposed project will have significant adverse effects on fish and wildlife resources. The proposed dredging of a portion of Pass Fourchon will destroy less mobile benthic invertebrates and create turbid water conditions that will temporarily reduce phytoplankton production. Excavation of the proposed boat slip will create a dead-end canal system 20 ft deep and 400 ft wide. It is possible that the boat slip will, because of the depth involved, possess poor circulation characteristics that will lead to stratification and formation of a zone of deoxygenated water and associated anaerobic organic sediments. This could, consequently, result in emission of toxic substances such as hydrogen sulfide and cause chronic fish kills in the canal and adjacent waters of Pass Fourchon.

Spoil disposal on the areas which have previously received dredged material will have minor effects on wildlife resources. However, spoil disposal and road construction in the impounded marsh and open water will destroy approximately 172 acres of valuable wetlands and eliminate those fish and wildlife values described above.

In order to reduce project damages to fish and wildlife resources, the Fish and Wildlife Service recommends that the permit be denied unless the following conditions are made a part of the issued permit:

1. The roadway shall be realigned to the south so that all areas presently composed of open water lie outside of the proposed project area and the amount of marshland impacted by the project be reduced to the lowest practicable acreage.

2. The depth of the proposed canal shall be limited to that absolutely necessary to accommodate the anticipated vessel use.

3. The bottom of the canals shall not contain pockets that will act as traps for stagnant water.

4. Applicable water quality criteria for the area shall be maintained within the canals. If water quality falls below these standards due to pollutants originating in the canal system or associated development, the permittee shall be required to correct the problem by such means as furnishing supplemental flows to increase circulation or installation of bottom aerators.

5. Facilities for the proper handling of boat and site-generated sewage, litter, other waste and refuse, petroleum products, and precipitation runoff shall be provided." (U.S. Department of the Interior, Fish and Wildlife Service, 1976)

3. U.S. Department of Commerce, National Marine Fisheries Service (8 March 1976)

The National Marine Fisheries Service (NMFS) has also made substantial environmental comment on the project. Excerpts from its review best states its environmental impact analysis.

"The NMFS is concerned with the adverse effects that the proposed filling could have on fishery resources. Major adverse impacts to the resources for which we are responsible and which would apply to the proposed fill include loss of productive marshes and shallow water bottoms which would reduce nursery and feeding habitat and detritus and nutrient sources. Although these wetlands have been segregated from adjacent estuaries, the NMFS considers these wetlands to be productive resources because they still export detritus and nutrients to adjacent waters and have the potential to again serve as nursery and feeding habitat for large numbers of marine and estuarine organisms.

Therefore, the NMFS recommends the permit be denied unless the following recommendations are made a part of the issued permit:

1. The northeastern limits of the proposed fill and the proposed road alignment shall be revised as shown on the enclosed drawing to reduce the amount of wetlands to be filled by approximately 50 acres.

2. To partially mitigate the loss of the approximately 100 acres of wetlands that would still be filled, the water control structure for the diked area shall be kept open to allow movement of estuarine and marine organisms

to and from the waters within the diked area. The structure may be closed, to restrict water inflow and thus reduce erosion of the roads within the area, only during periods when tidal stages exceed 1.18 ft msl. The Corps of Engineers has determined the mean high tide is 1.18 ft msl at their tide gauge on Bayou Lafourche at Leeville. The applicant shall maintain a complete record of all the dates that the water control structure was closed. Subject records shall be available for inspection by representatives of the NMFS at any time.

We understand that the applicant is studying various options for managing the undeveloped remainder of the wetlands within the diked area for fish and wildlife purposes. We would consider modification of recommendation number 2 upon review of any management plan submitted by the applicant which would allow use of the area by estuarine and marine organisms and thus serve to mitigate the loss of the wetlands to be filled." (U.S. Department of Commerce, National Marine Fisheries Service, 1976.)

E. EXISTING AND PROPOSED AREA-WIDE PLANNING AGENCIES

The following existing planning agencies have authority over or concern for the project. There are no proposed agencies at the present time.

1. Louisiana Department of Transportation and Development

This agency is the Coastal Zone Management coordinating agency for the state and is responsible for developing guidelines, determining need, and establishing priorities for Coastal Energy Impact Program projects in Louisiana. An allocation process has been developed.

2. South Central Planning and Development Commission

This agency has completed its review of the project, has found it in complete conformance with their comprehensive planning goals, and supports its development.

3. South Lafourche Regional Planning Commission

This agency has reviewed the project and found it to be in full compliance with its plan for land usage and the commission's plans of economic development and employment opportunity and stabalization.

4. Regional Planning Commission, Jefferson, Orleans, and St. Tammany Parishes

This agency has found that the proposed project does not conflict with regional comprehensive planning processes in progress.

5. Jefferson Parish Planning Department

Although this agency has no legal status, they reviewed the project because of its proximity to Grand Isle. They feel it will have a positive impact and is in conformance with their comprehensive planning needs.

F. OTHER SOURCES OF FUNDING CONSIDERED

Funding for the project was considered through Title IX, Economic Development Administration. On January 2, 1976, it was found that the project was not eligible for Federal funds under Title IX and it was suggested that the Port Commission make application under Title I, Section 403(J). A preapplication was made and in July 1976 EDA found the project to be eligible for funding and that the project could compete with similar applications. EDA was also agreeable to considering the requested amount in a formal application.

In October of 1976 the Port Commission decided not to pursue funds under Title I any further because of depletion of funds that were to be used for matching the grant. No new matching funds were available and the Port Commission did not see any way to come up with the local funds to match Title I funds for a project of the scope and size proposed.

SECTION 10: CONSULTATION AND COORDINATION WITH OTHERS

A. AGENCIES

The following is a list of Federal, state, and local agencies contacted in relation to the project. It includes dates of letters of response.

1. Federal

Army Corps of Engineers, New Orleans District
Dated: February 12, 1976
Signed by: James F. Roy
Acting Chief, Planning Division

Army Corps of Engineers, New Orleans District
Dated: December 19, 1975
Signed by: James F. Roy
Acting Chief, Planning Division

Coast Guard
Department of Transportation
No Response

Department of Commerce, National Marine Fisheries Service
Dated: March 8, 1976
Signed by: William H. Stevenson
Regional Director

Department of the Interior
National Park Service, Southwest Region
Dated: December 16, 1957
Signed by: Margaret G. Twyman
National Historic Landmark Specialist

Department of the Interior Bureau of Sports, Fisheries, and Wildlife
(a) Dated: January 23, 1976
Signed by: S. Ray Aycock, Jr.
Assistant State Supervisor

(b) Dated: March 8, 1976
Signed by: Kenneth E. Black
Regional Director

Soil Conservation Service
Dated: December 16, 1975
Signed by: Wayne J. Bordelon
District Conservationist

2. State

Air Control Commission
Dated: December 19, 1975
Signed by: Vernon C. Parker, P.E., M.P.H.
Chief Air Quality Section
Louisiana State Division of Health

Commission on Intergovernmental Relations
Dated: April 15, 1976
Signed by: Regis Allison
State Clearinghouse Director

Department of Art, Historical and Cultural Preservation
Dated: December 5, 1975
Signed by: Dorothy H. Gibbens
Anthropologist

Department of Public Works
Dated: December 11, 1975
Signed by: Daniel W. Cresap
Chief Engineer

Department of State Planning
Dated: December 17, 1975
Signed by: James R. Renner

Louisiana Geological Survey
Dated: December 17, 1975
Signed by: Harry L. Roland, Jr.
Assistant State Geologist

State Conservation Department
Dated: December 16, 1975
Signed by: Arnold C. Chauviere
Assistant Commissioner

State Parks and Recreation Commission
Dated: December 17, 1975
Signed by: Leslie Kent, Jr.
Landscape Architect

Tourist and Development Commission
Dated: December 10, 1975
Signed by: Paul F. Stahls, Jr.
Advertising and Publicity

Wild Life and Fisheries Commission
Dated: February 9, 1976
Signed by: Fred Dunham
Biologist, Environmental Section

Wild Life and Fisheries Commission
Dated: January 6, 1976
Signed by: J. Burton Angelle
Director

Wild Life and Fisheries Commission, Division of Water Bottoms and Seafood
Dated: February 11, 1976
Signed by: Harry E. Schafer,Jr
Chief Oysters, Water Bottoms and Seafoods Division

3. Local

Jefferson Parish Planning Commission
Dated: April 2, 1976
Signed by: Hugh N. Ford
Planning Director

Lafourche Parish Police Jury
Dated: November 10, 1977
Signed by: Robert H. Simons
Director, Department of Public Works

South Central Planning and Development Commission
Dated: January 19, 1976
Signed by: Mike Straussen
Regional Planner

South Lafourche Regional Planning Commission.
Dated: November 10, 1977
Signed by: Martin Bruno, Jr.

Teche Regional Clearing House Review Board
Dated: March 26, 1976
Signed by: Anne Harmon
Secretary, Clearing House

Regional Planning Commission. Jefferson, Orleans, St. Bernard, St. Tammany
Dated: April 6, 1976
Signed by: Charles T. O'Doniel, Director

St. Bernard Parish Planning Commission
Dated: March 30, 1976
Signed by: Angelo Chetta
Director

B. PUBLIC PARTICIPATION

A Public Notice, LMNOD-SP (Pass Fourchon) dated December 9, 1975, was issued. This notice was relative to the proposal by the Greater Lafourche Port Commission to dredge a channel and slip and install and maintain a road between Highway 3090 and Bayou Lafourche.

C. PRIVATE PARTICIPATION

The following is a list of private organizations or businesses contacted in relation to the project. It includes dates of letters of response.

Lafourche Telephone Company
Dated: January 5, 1975
Signed by:

Louisiana Power and Light
Dated: December 17, 1975
Signed by: W. E. Bond
Industrial Engineer

Martin Bruno, Jr., Planning Consultant
Dated: November 10, 1977
Signed by: Martin Bruno

South Lafourche Chamber of Commerce
Dated: December 22, 1975
Signed by: Grady H. Woodham

URS/Forrest and Cotton, Inc., Consulting Engineers
Dated: February 13, 1976
Signed by: Martin Bruno

ENVIRONMENTAL DISCUSSION

SECTION A: LAND USE

A. DEVELOPMENT IMPACT

1. The Project Site

The project site (Fig. A-1) is an area of enclosed marsh and low spoil (Fig. A-2) bounded by Louisiana Highway 3090, Pass Fourchon, Bayou Lafourche, and open marsh and water near the Gulf of Mexico in coastal Louisiana. Present land uses include marsh associated recreation and some industrial/commercial activity and docking along Bayou Lafourche.

Figures A-1 and A-2 are referred to throughout this part of the report and are included here for ease of reference.

Regionally (Fig. A-3) the site is at the southern end of the Lafourche corridor and is surrounded by coastal marshes and waterbodies. Regional land uses (Fig. A-4) include recreation, commercial fishing, and petroleum-related activities. The nearest population centers are Grand Isle and Leeville. The heavily settled part of the Lafourche corridor ends at Golden Meadow.

2. Land Use Map

The land use map of the parish developed by the South Central Planning and Development Commission, 1974, depicts the Port Fourchon area under the category of "Recreation." This area is still part of a research study area used by the Wild Life and Fisheries Commission (as denoted in a letter from its Director, Mr. J. Burton Angelle to Coastal Environments and dated January 6, 1976). Presently there is public hunting permitted in the area and the public enjoys the recreational opportunities offered within its boundaries.

According to Subdivision Regulations Ward 10, Lafourche Parish, Louisiana, every subdivision of land within the Parish of Lafourche, excluding incorporated areas, shall be shown on a plot and submitted to the Commission having jurisdiction for review and recommendations, and forwarded thereafter to the police jury for grant or disapproval. The police jury has consistently supported construction of the proposed facility on this site. Since recreation is expected to continue on land surrounding the immediate project area there is no major land use conflict.

There is a Model Zoning Ordinance but no ordinance is presently in effect. Thus there is no conflict with zoning and an amendment will not be necessary for construction of the project.

There are no known conflicts between the objectives of any existing or proposed state or local land use plans and this project. Comprehensive plans relating to Coastal Zone Management are presently being developed by the Louisiana Department of Transportation and Development in conjunction with other agencies.

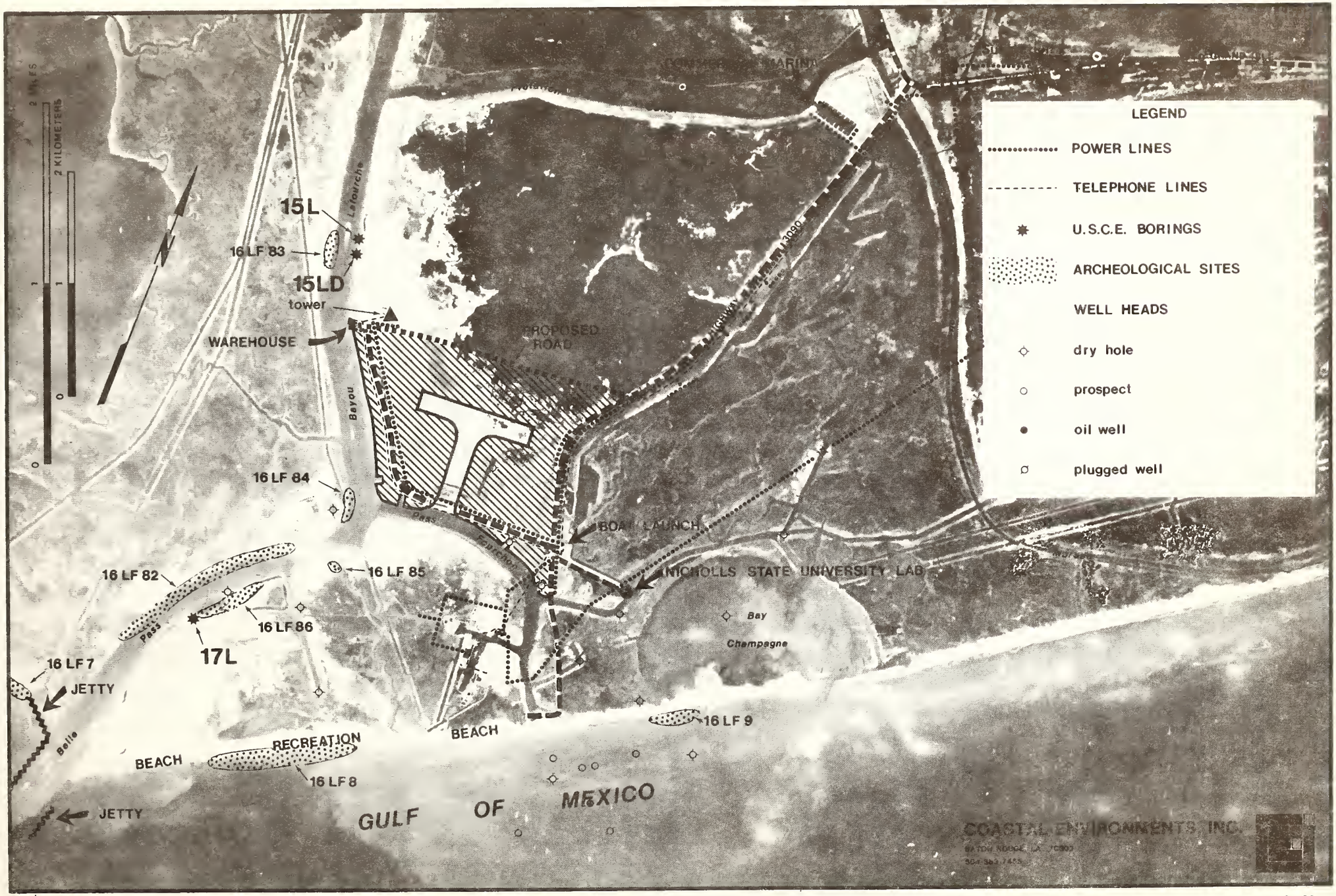


Fig. A-1. Port Fourchon area. Land-use plan, development facilities, oil & gas wells location, highways, power, communication and transmission lines, and archaeological sites.

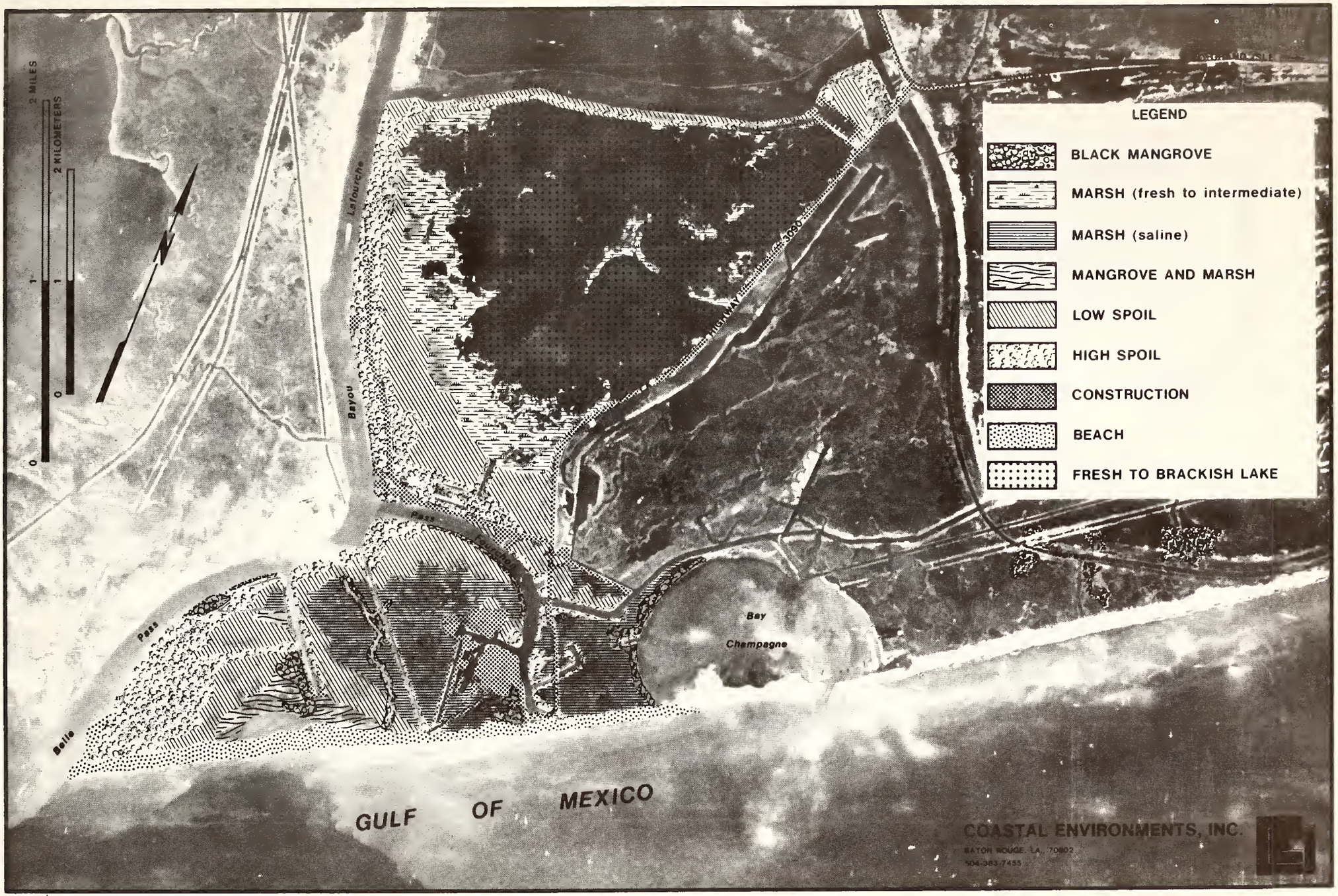


Fig. A-2. Different environments and vegetation of the study area.

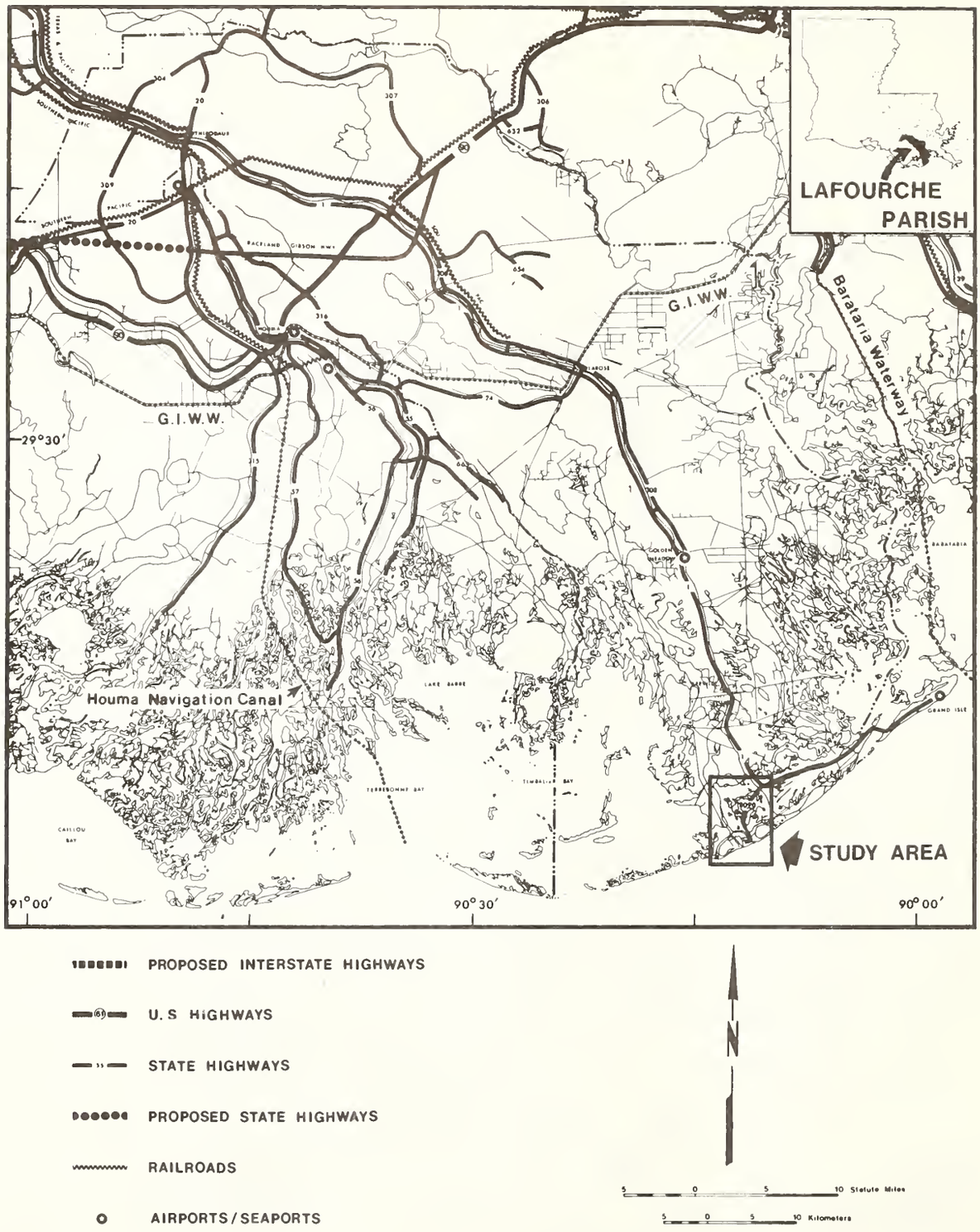


Fig. A-3. The Port Fourchon study area in relation to the remainder of Lafourche Parish. Included are the transportation systems of the parish.

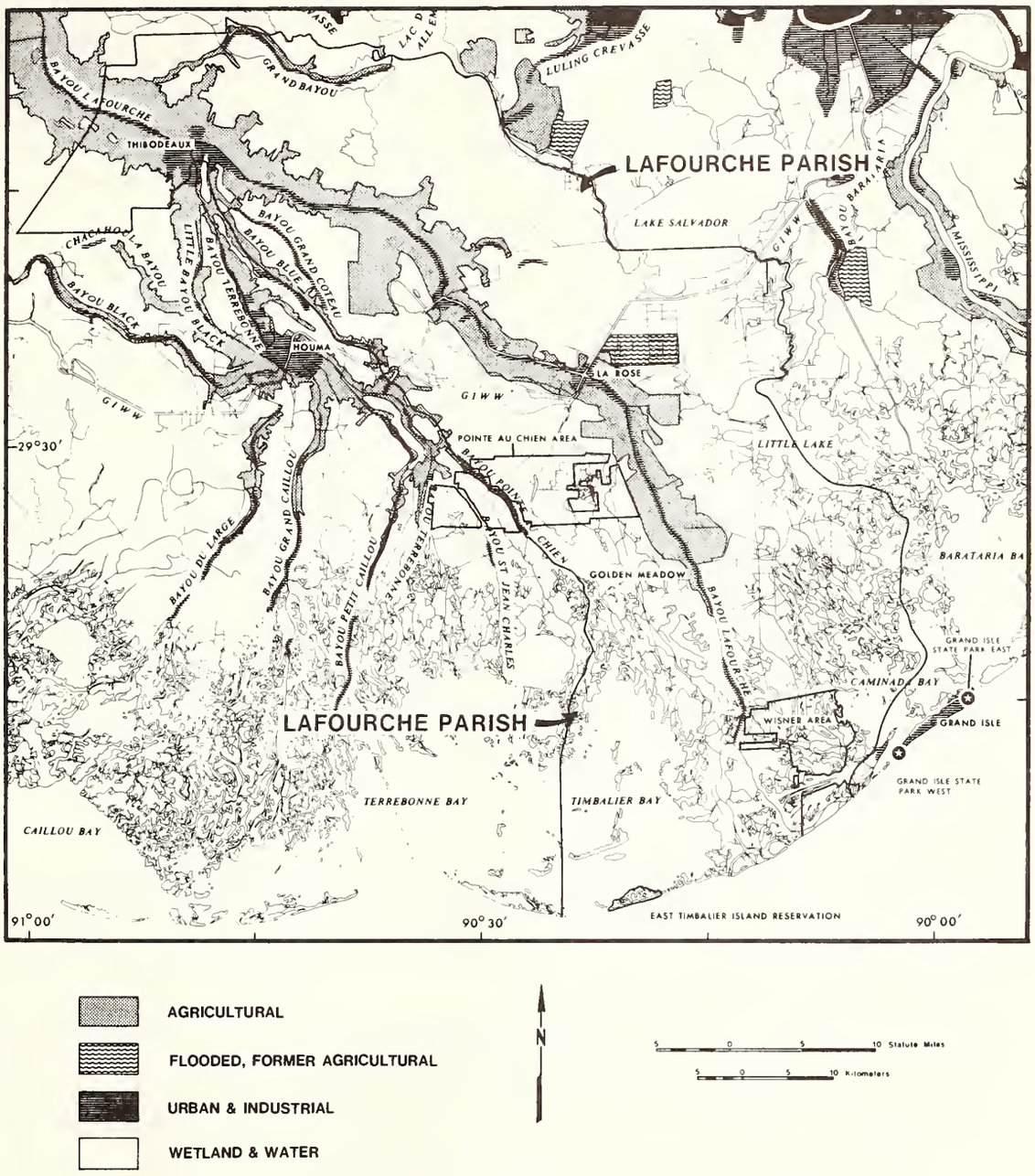


Fig. A-4. Land use map of Lafourche Parish.

B. IMPACT ON OTHER COMMUNITY FACILITIES

The projected maximum population for this project is 371 households (GSRI, 1974), or about 1000-1300 people. This growth is expected to be dispersed over a number of years and will be added to the population at Grand Isle and in the corridor north of Golden Meadow where community infrastructure presently exists. This increment of population is considered consistent with normal growth expected in the region and will not place sudden and unpredicted stress on community facilities such as schools, hospitals, recreational resources, transportation facilities, fire stations, or libraries. Current wastewater treatment and water supply systems can accommodate this increment of growth.

This project is in the same general area as some other public works and programs which are summarized below.

Department of Public Works - Two projects in the vicinity of the study area (upon which construction is complete) have had engineering services provided by the Department of Public Works.

The two projects, a timber bulkhead at the location of the Port Fourchon Marine Laboratory (Nicholls State University), and its extension were constructed in 1973 and 1974 respectively. The Department of Public Works is also funding the modifications to the Belle Pass jetties, however, the Greater Lafourche Port Commission is handling these contracts.

Louisiana Wild Life and Fisheries Commission - The Fourchon area is presently a research study area for the Commission. They strongly recommend that any activities in this area be coordinated with the Commission.

Louisiana Department of Transportation and Development - A Coastal Zone Program is currently being developed by this agency. The Department expects that the Port Fourchon development program will be compatible with their program goals.

South Lafourche Regional Planning Commission - Their present zoning ordinance map of Ward 10, Lafourche Parish, where the Fourchon Area is located, is not presently in effect according to the information supplied by the South Central Regional Planning and Development Commission.

U.S. Army Corps of Engineers, New Orleans District - The U.S. Army Corps of Engineers, New Orleans District activities in relation to Bayou Lafourche and the Port Fourchon Area at Belle Pass can be summarized as follows: The River and Harbor Act of 30 August 1935 House Document 45, 73rd Congress, 1st Session provides for a permanent closure of Bayou Lafourche without lock, at Donaldsonville, Louisiana at the junction of Bayou Lafourche and the Mississippi River; a channel 6 ft by 60 ft from Napoleonville to Lockport; a channel 6 ft by 60 ft from Larose to the Gulf of Mexico with a jettied entrance at Belle Pass; and the closure of Pass Fourchon.

The spoil areas which will become part of the Port Fourchon facility are small. There appears to be sufficient capacity in the adjacent areas and in the other section of the Fourchon project. There are no known Corps of Engineers conflicts with the proposed action. The deposition of spoil material from dredging operations and the filling of some areas with this material have already received approval by the Corps of Engineers.

C. MAP INFORMATION

The map information related to the following sections is included in Figures A-1 and A-2 previously presented, or on individual maps related to the specific discussion topic.

D. GEOLOGY AND PHYSIOGRAPHY

1. General Structure

The Port Fourchon study area is centered on latitude 29°07'N and longitude 90°12'W (Fig. A-3). The area is in the Gulf Coastal Plain in the south central section of the Mississippi deltaic plain. For the past 6000 years, coastal Louisiana has been an area of active sediment accumulation. As a result of the aggradation and degradation of the shoreline, the geomorphic expressions and the geologic features are associations of depositional environments which have easily recognized and predictable characteristics.

Mississippi River deposits are accumulating in the Gulf Coast Geosyncline, a downwarp in the earth's crust extending from Florida to the northeastern part of Mexico. The area that resulted as a consequence of the geosyncline comprises a wide area of sedimentary deposits as thick as 50,000 ft in some areas. Fig. A-5 shows the location of the axis of the Gulf Coast Geosycline in relation to the Port Fourchon area. The geologic column for the study area is shown in Table A-1.

The Mississippi River deltaic plain is a series of aggrading and retreating sedimentary lobes (Fig. A-6 and A-7). Frazier (1967) divides the deltaic plain into five complexes and sixteen subdeltas which began to form when sea level reached its present level about 7000 years ago. At that time, the main channel of the ancient Maringouin Delta was in the center of the entrenched Mississippi Valley. Sediment began to accumulate over the weathered surface of the older Pleistocene deposits. Beneath the study area, the contact between the Pleistocene and the Recent is between 500 ft and 700 ft (Fig. A-8). The Mississippi trench passes beneath the study area and is the reason for the extreme depth of the Pleistocene contact.

The Pleistocene is composed of a series of depositional facies similar to the environments found in the present Mississippi delta plain (Table A-2). The Pleistocene dipping to the south and west is crossed by a number of stream valleys eroded when sea level was lower. The Pleistocene surface has been subjected to thousands of years of consolidation, desiccation, oxidation, and erosion when sea level was lower.

The part of the coast in the project area was an interdistributary basin until approximately 900 years ago. From 700 years before present to 900 B.P. clays and nearshore sands and silts accumulated above the long since inundated Pleistocene surface. Frazier (1967) shows the Bayous Lafourche and Terrebonne subdeltas as contributing most to the formation of Lower Lafourche Parish. It is the remnants of the Bayou Lafourche subdelta which are found today. The subdelta, which has been regressing for the past 600 to 700 years, is a shoreline of cheniers, beaches, barrier islands, and spits (Fig. A-9). The sand and shell which form these features are the residual sediment accumulated from the winnowing of the finer constituents. In the study area the Bayou Lafourche subdelta deposits have buried the cheniers which characterized this section of the coast.

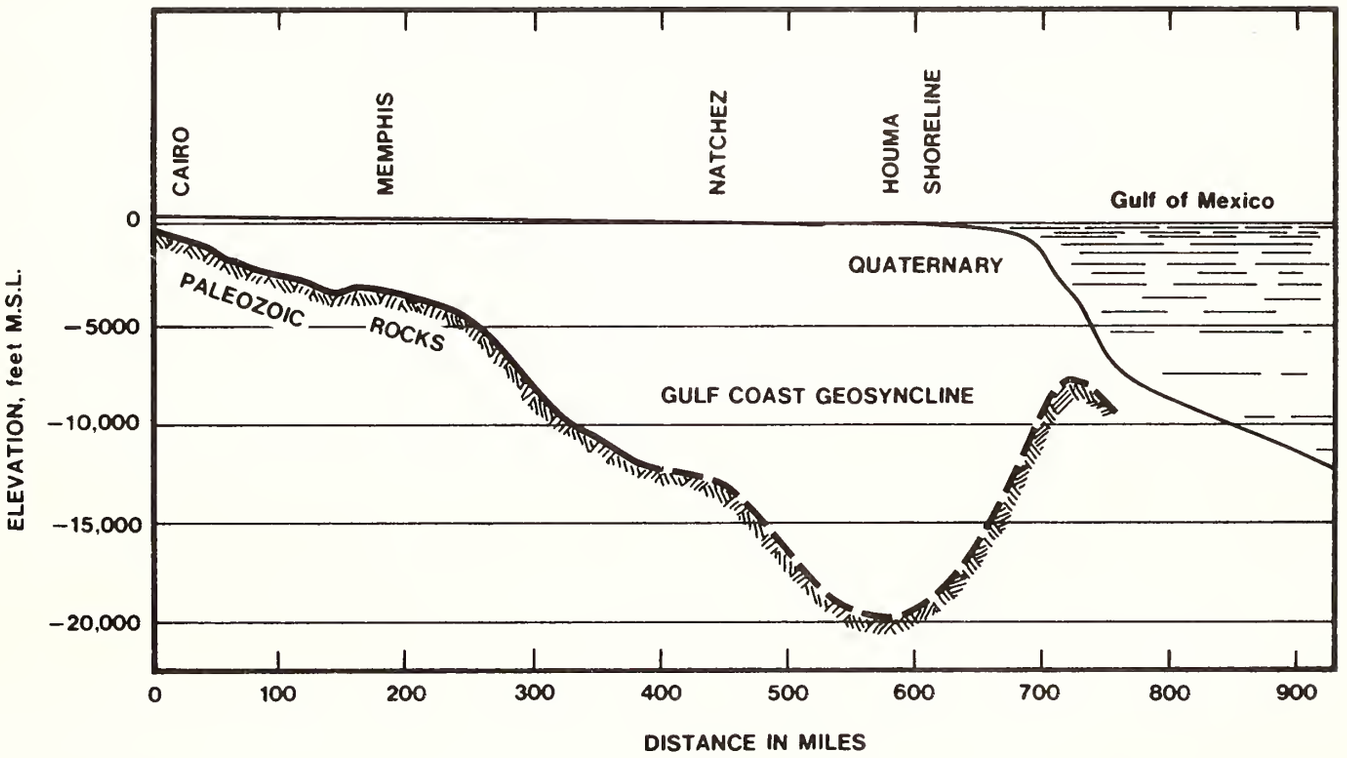


Fig. A-5. The Gulf Coast Geosyncline in the vicinity of Port Fourchon.

Table A-1. Geologic column of the study area.

EPOCH	GROUP	FORMATION	LITHOLOGY	INDEX FOSSILS
Holocene	River deposits	Meander belts and deltaic plain deposits, alluvium	See Table 1, page A-12	
Plio-Pleistocene	Terraces	Citronelle	Basal sands and gravels, clays and silts above Citronelle - sandy pebble conglomerates; fine and medium sandstone; some mudstone; cherts and orthoquartzites from Appalachian or Ouachita Mountains; crossbedding, channeling, cut and fill structures	
		Prairie	Clayey sandstones, fine to very fine sandy siltstones; sandy pebble conglomerates; fluvial sedimentary structures; light grey, light brown, yellowish orange in color; more finely grained than Citronelle, quartzose, chert, hematite, authigenic pyrite	

(Continued)

Table A-1. (Continued)

EPOCH	GROUP	FORMATION	LITHOLOGY	INDEX FOSSILS
Miocene	Grand Gulf Group	Fleming/ l Harang Fauna (downdip)	Interfingering sands, silts and clays of deltaic origin; brackish water silts and clays	Upper portion *Rangia* (*Miorangia*) *microjohnsoni* {mollusk} *Rotalia beccarii* (A) Upper portion - downdips *Lenticulina vaughani* {="*Robulus* E"} *Bigenerina floridana* *Textularia stapperi* Middle portion *Potamides matsoni* {mollusk} Middle portion - downdips *Bigenerina humblei* *Globarotalia fohsi* *Uvigerina lirettensis* Lower portion *Amphistegina* "B" *Operculinoides* sp. *Rombulus chambersi* Lower and middle portion - farthest downdips *Cibicides opima* Harang fauna *Planulina harangensis* *Liebusella* sp. *Cyclammina* sp. Basal portion *Marginulina ascensionensis* *Siphonina davisi*
		Catahoula	Fresh water sands and silts, petrified wood fragments; root tubes, fossilized grasses; silty clays with leaf-bearing beds	
		Chicka-sawhay	Shale beds, deltaic deposits	

Source: U.S. Army Corps of Engineers, 1974 Preliminary Draft Environmental Statement, Atchafalaya Basin Floodway, Louisiana, New Orleans District.

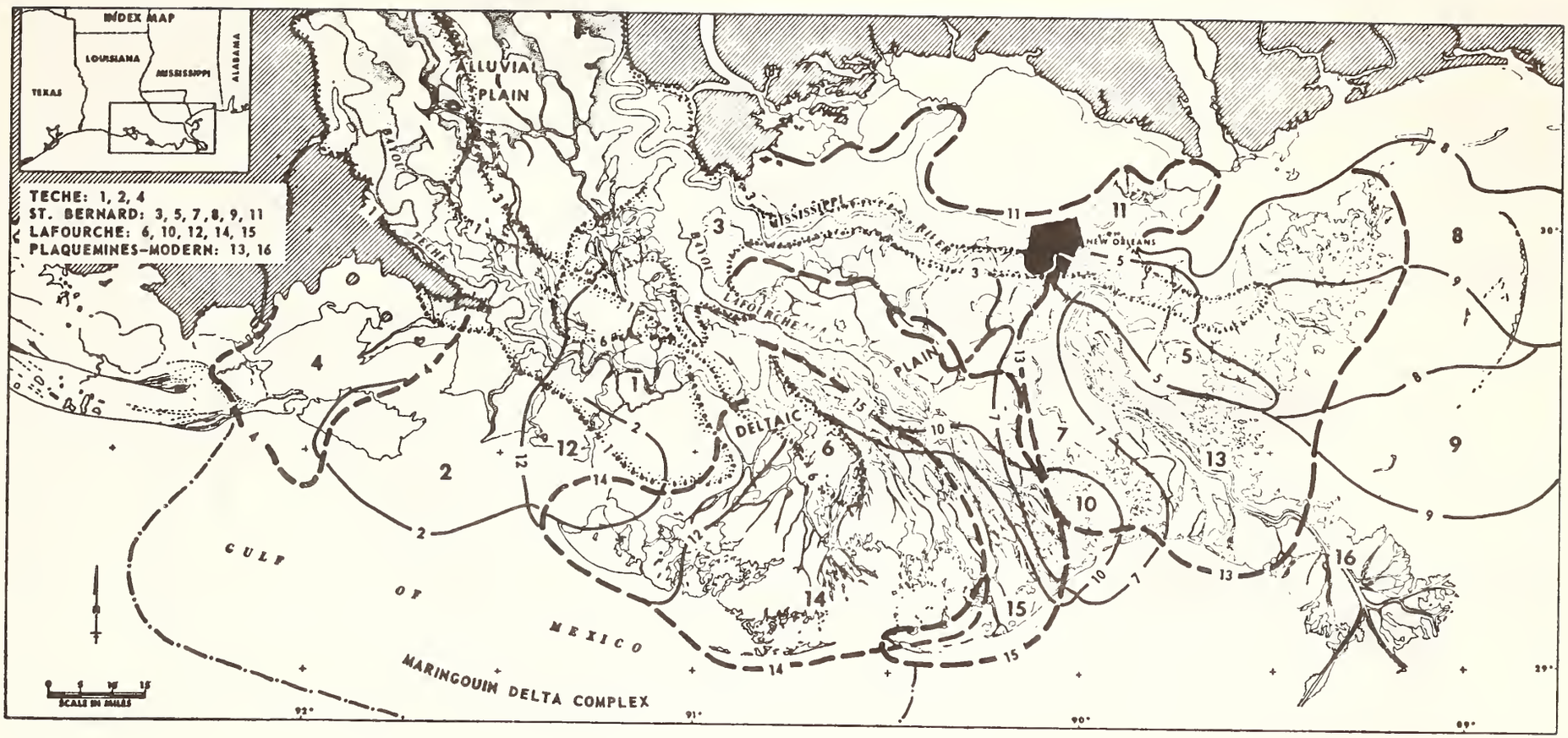


Fig. A-6. Map of the deltaic sequence in south Louisiana (after Frazier, 1967).

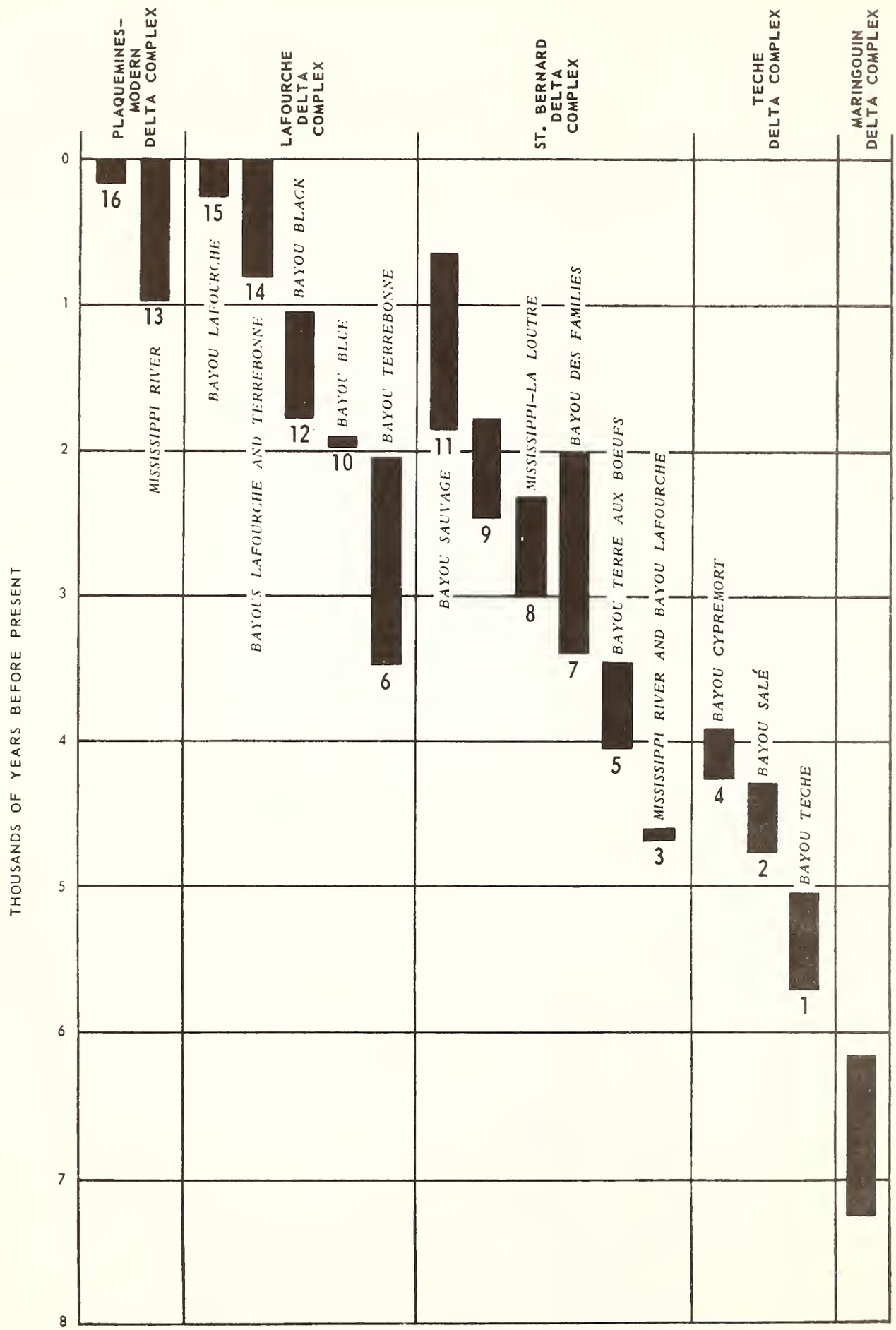


Fig. A-7. Chronology of the deltaic sequences in south Louisiana (after Frazier, 1967).

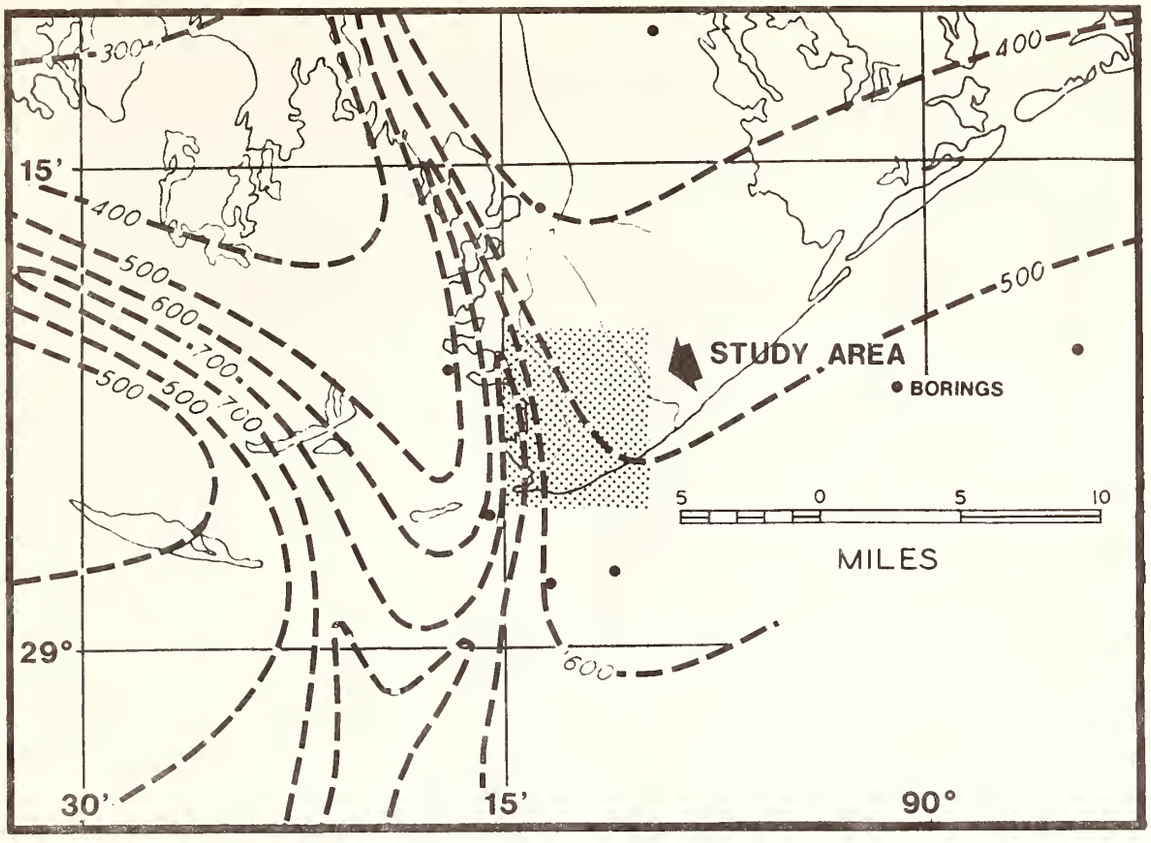


Fig. A-8. Contours showing depth to the top of the Pleistocene formations.

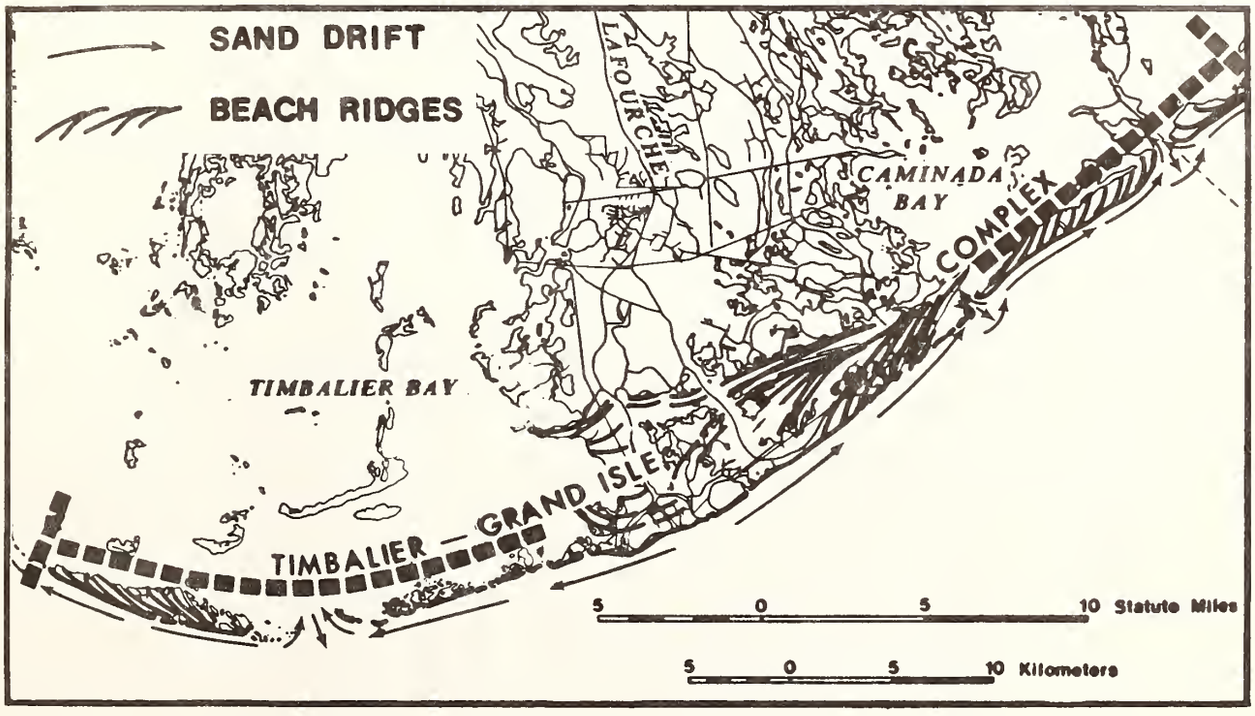


Fig. A-9. Physiography of the study region.

Table A-2. Physical characteristics of depositional environments.

ENVIRONMENTS		PHYSICAL CHARACTERISTICS										
		GRAIN SIZE	SEDIMENTARY STRUCTURES	COARSE FRACTION	ORGANIC CONTENT	PYRITE CONTENT	CARBONATE CONTENT	IRON OXIDE CONTENT	OXIDIZING OR REDUCING	PREDOMINATE[1] SOIL TEXTURE	COMPONENT SERIES	SUITABILITY FOR CONSTRUCTION
PRE-RECENT	PLEISTOCENE	mostly clays with remainder silt and sand	The Pleistocene surface was an ancient former deltaic plain of the Mississippi River. The depositional environments and lithologies are similar to those found in recent deltaic plsins.							CH, CL	none exposed in study area	good
RECENT	NATURAL LEVEE (LEVEE RIDGE)	sands to silty clays	roots disrupt and distort bedding; burrows	iron along root burrows	root voids; oxidized	moderate	moderate	high	reducing	CH, CL, ML, SM	Commerce series Sharkey	good-fair
	POINT BAR	sands and silts	cross-bedding, ripples, contorted beds	grain size increases with depth	along ripple faces	moderate	moderate	high near surface	oxidizing near top; reducing near bottom	ML, SM, SP, CL	ridges-Tunica swales-Sharkey	good-fair
	WELL DRAINED SWAMP (BACK LEVEE)	silty sands to silty clays	absent or disturbed by roots	iron nodules and oxides along root burrows	usually oxidized away; root voids	moderate	moderate	abundant	reducing	CH-CL	Sharkey	fair
	POORLY DRAINED SWAMP (MARSH)	clays, very little silt	root burrows throughout	considerable organic matter; pyrite; vivianite	peats; organics content high	abundant	low	moderate	reducing	CH-CL	Sharkey	not suitable
	LACUSTRINE	clays	varves, well developed layers	invertebrate fossils, bivalves, gastropods, frequent concretions	low, in reworked layers	rare	moderate	rare	reducing	ML, SM, SP	none exposed in study area	not suitable
	LACUSTRINE DELTA FILL	clays to silts and silty clays	parallel laminations, ripples, lenticular laminations, some bedded organics	choraphytes mica, pyrite	low	moderate	moderate	moderate	oxidizing to reducing		none exposed in study area	fair-poor
	SUBSTRATUM	gravel to sand from bottom to top	Massive deposits of sand and gravel which constitute the basal fill of the entrenched valley become coarser with depth and may reach a thickness of 300 feet in the deepest portions of the entrenched valley.							SP	none exposed in study area	fair

1. Unified Soil Classification System

The Recent formation can be divided into seven depositional environments. All of these facies are common in a deltaic cross-section and are distinguished by recognizable physical parameters (Table A-2). In the study area only the natural levee and marsh environment are present. Fringing the shoreline are reworked sand and shell beaches. Fig. A-2 shows the environments of the abandoned geomorphic features. Borings which were taken in the study area by the U.S. Army Corps of Engineers are shown in Fig. A-10.

Elevations along the natural levees of Bayou Lafourche range from less than 5 ft MSL at Leeville to sea level at the mouth of Bayou Lafourche. The brackish marshes in the interdistributary basins are at or just above sea level. The marshes are inundated during high tides and south winds. The Bayou Lafourche delta complex has undergone subsidence, consequently enlarging the bays, lakes, and marshlands in this area. Subsidence rates for Louisiana coastal areas have been established at 0.70 ft per century (Fig. A-11).

The present seaward edge of the Lafourche delta complex is one of the most rapidly retreating parts of the Louisiana coastline. Retreat rate estimates vary from 20 m to over 33 m per year (Morgan and Larimore, 1957; Gagliano and van Beek, 1970). The shoreline erosion rate for the Port Fourchon area was recently determined to be in some places 22.86 to 30.48 m per year (Whitehurst and Self, 1974). Figure A-12 shows historic and projected shoreline retreat in the Caminada-Port Fourchon area.

2. Subsurface Faults

Subsurface faults found near the study area are shown in Fig. A-11. Surface expression is absent even though displacement along a single fault may be as much as 2000 ft or more at great depths. Faults appear to be related to the regional trend of the Gulf Coast Geosyncline.

3. Salt Domes

Related to the thousands of feet of sediment in the Geosyncline is the occurrence of salt domes (Fig. A-11). The domes are cylindrical masses of salt that pierce through sedimentary strata from a mother bed at a depth of 20,000 ft or more. Economically, the salt domes are important for various reasons. Associated with the upthrusting of the salt stock, there is usually a peripheral upwarping of sedimentary strata adjacent to the dome providing structural traps for hydrocarbons.

4. Economic Geology

In the vicinity of the study area and in the offshore areas the principal geologic resources are oil and gas (Table A-3). The areas fronting the Lafourche Parish coastline contain 27% of the offshore oil wells drilled and 12% of the offshore gas wells drilled in the state

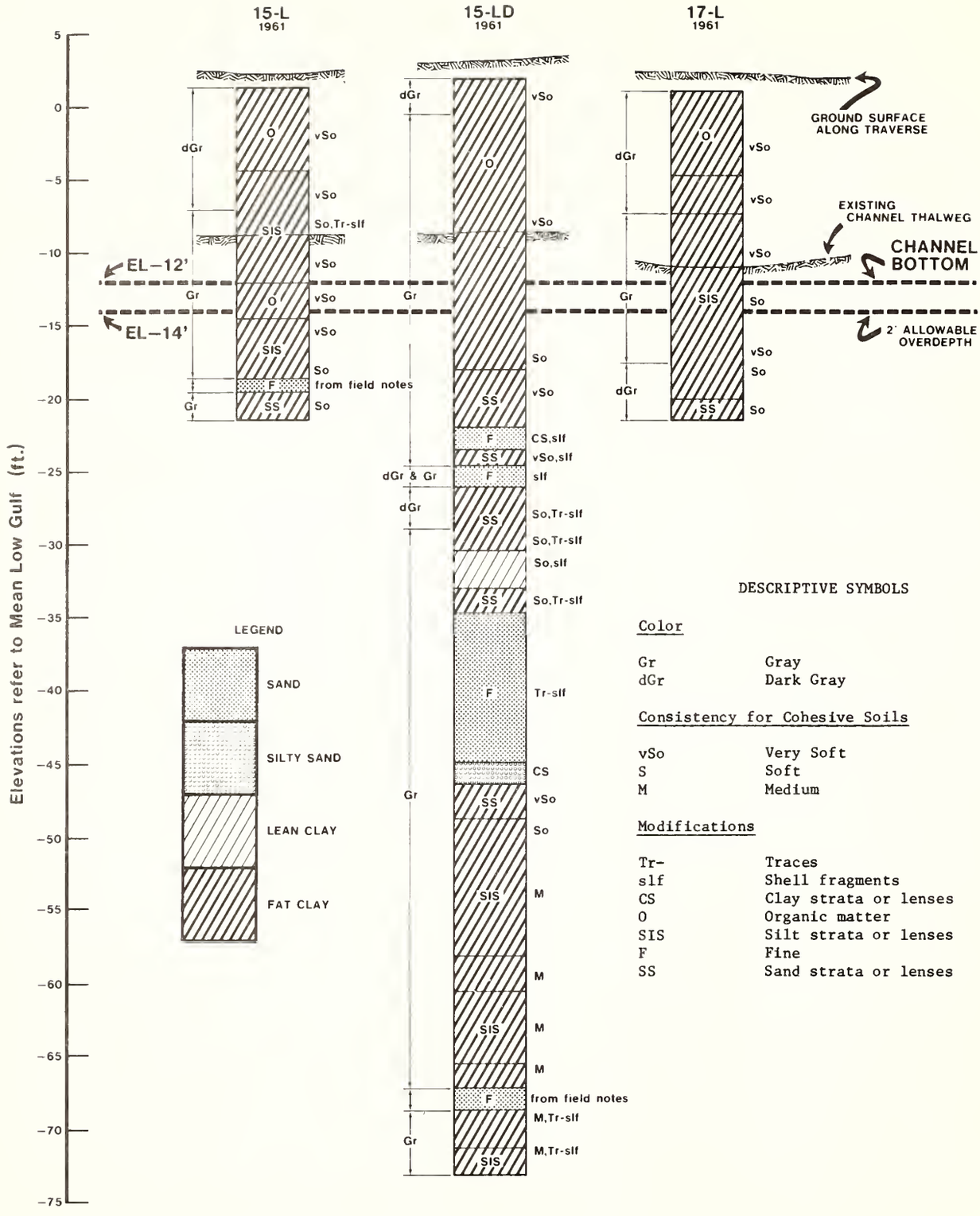


Fig. A-10. Geologic columns from the Port Fourchon area.

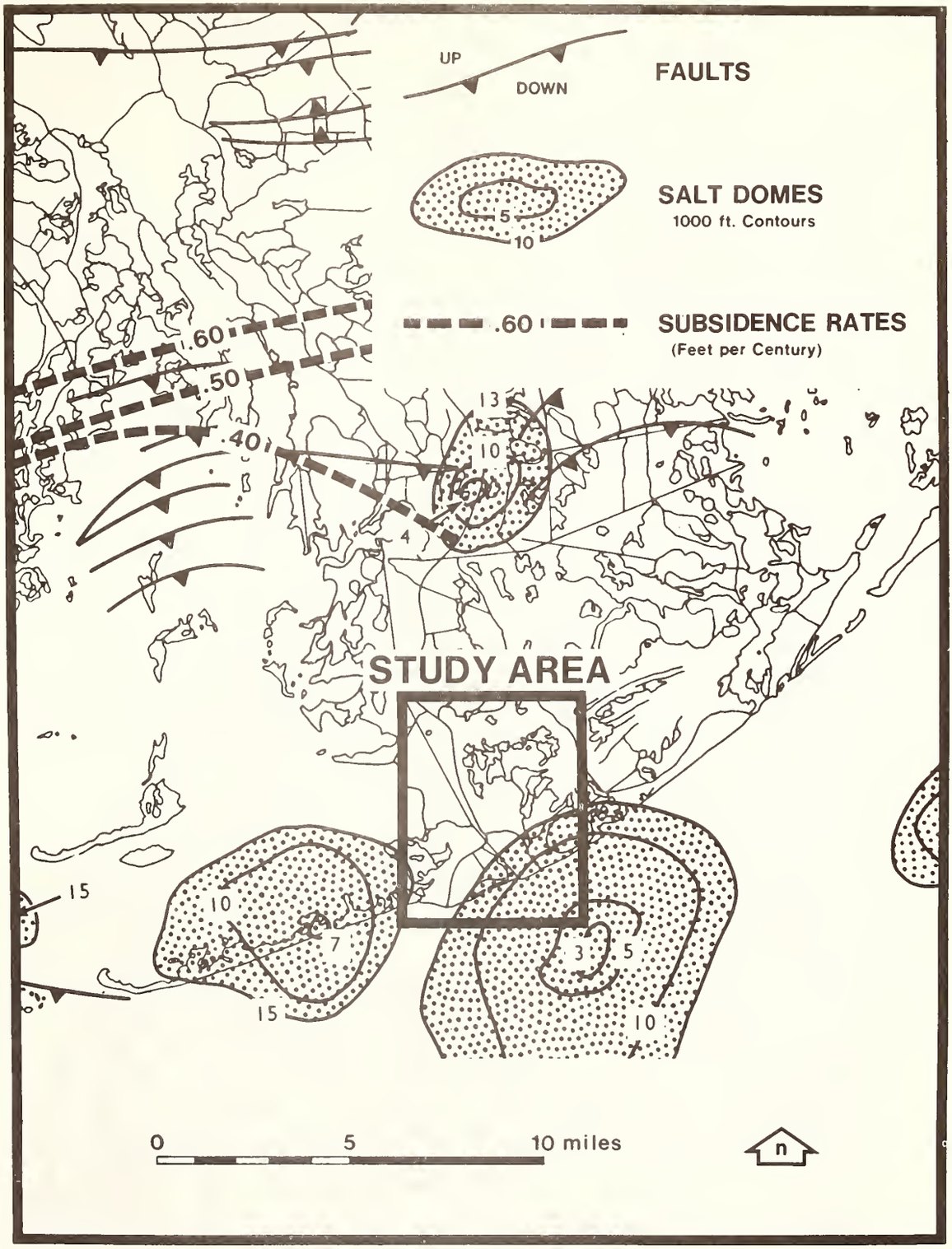


Fig. A-11. Subsidence rates, subsurface faults, and salt domes in the Port Fourchon area.

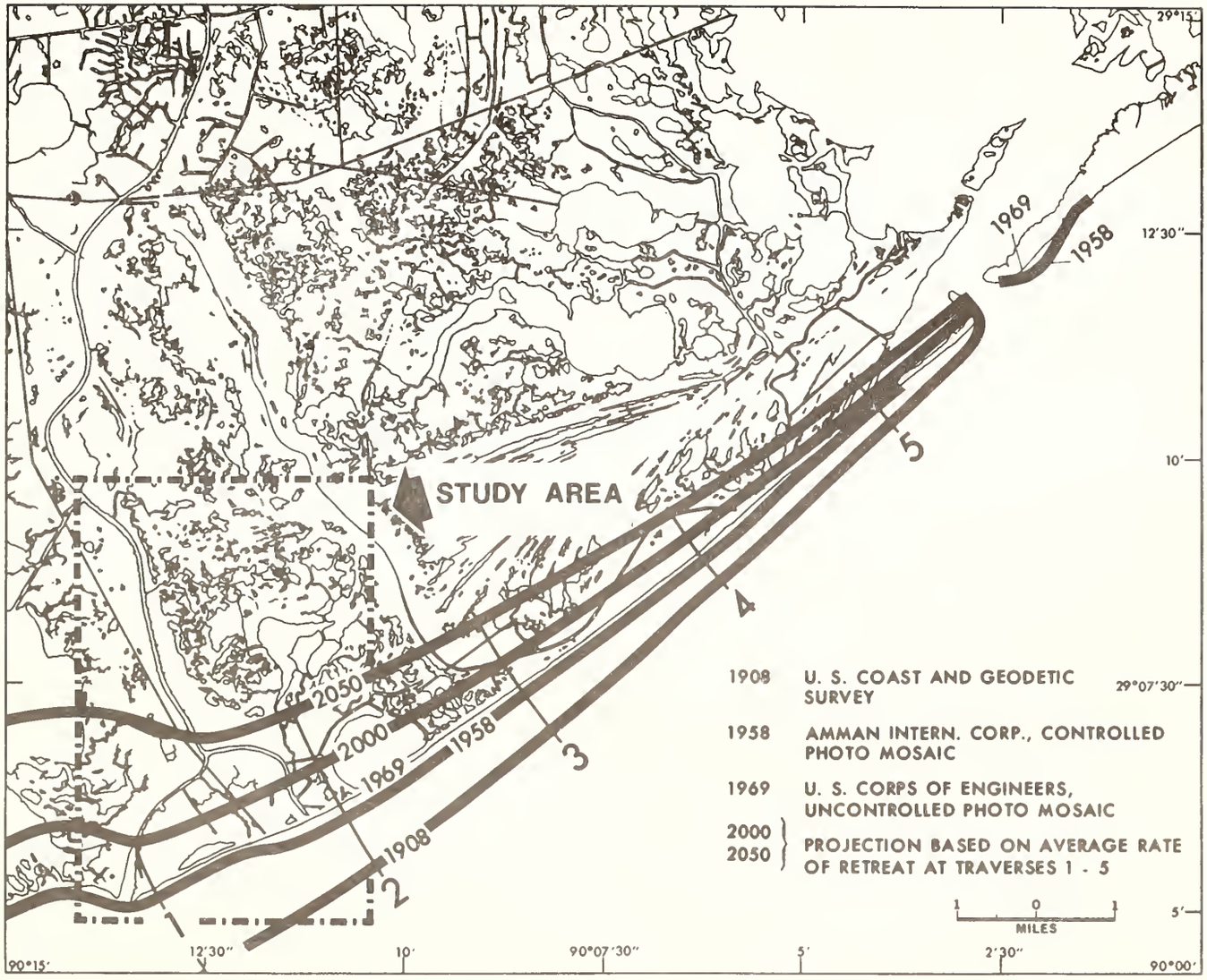


Fig. A-12. Historic and projected shoreline retreat in the Caminada-Port Fourchon area.

Table A-3. Oil and gas production in Lafourche Parish compared to Louisiana (1970).

	Crude Oil (Barrels)[a]	Condensate (Barrels)[a]	Casinghead Gas[b] (Mcf)	Natural Gas[b] (Mcf)
Louisiana (000)	787,138	117,699	1,104,941	6,691,805
Lafourche Parish (000)	117,674	8,272	138,586	296,994
Percent of Louisiana	14.9	7.0	12.5	4.4

[a]42 Gallon Barrel; [b]15.025 pounds per square inch absolute.

Source: Louisiana Department of Conservation, 1972.

in 1970. Many oil and gas pipelines cross the study area and its vicinity (Fig. A-13). Sulphur is also mined offshore of the project area.

A series of exploratory wells in search of hydrocarbons have been drilled in the Port Fourchon area since 1947. The only productive one in the immediate area is the State Lease 1365, No. 27 well just offshore in the Bay Marchand Block 2 Field and east of the project area in Bay Champagne (Fig. A-1).

5. Seismic Activity

Even with faulting throughout the coastal zone, seismic hazard in Louisiana is very low to non-existent (Algermissen, 1969, Algermissen and Perkins, 1976). The potential for seismic risk is described on a scale of 0 to 3 where Zone 0 means no damage, Zone 1 means minor damage, Zone 2 means moderate damage, and Zone 3 means major damage. The scale is based on historical data which considers only the intensity of the earthquake, not its frequency. In Louisiana the seismic potential is zero.

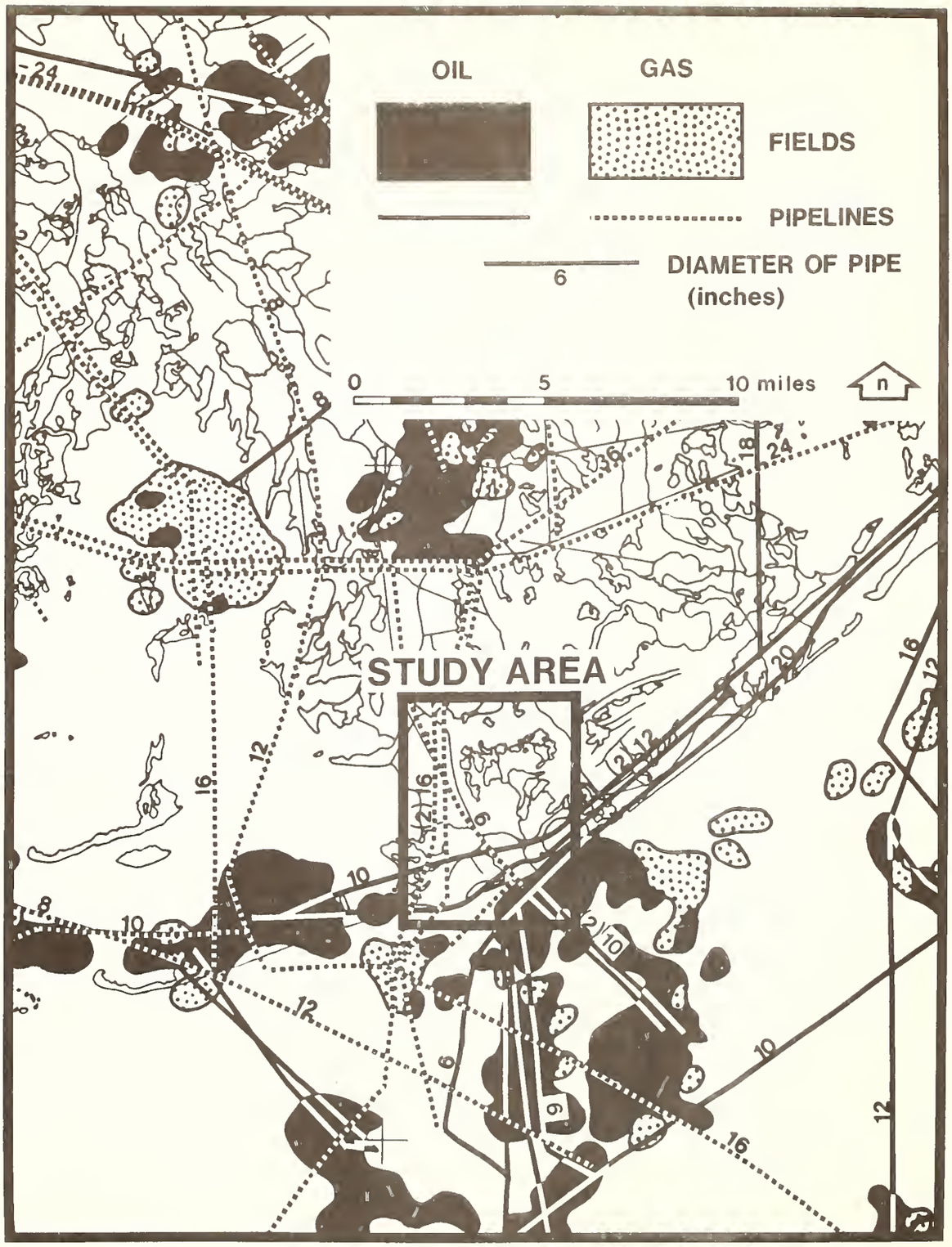


Fig. A-13. Oil and gas pipelines and petroleum fields in the Port Fourchon area.

E. HYDROLOGIC ELEMENTS

1. General Hydrology of the Deltaic Plain

The deltaic plain is an area of extremely low relief occupied by marshes, swamps, and numerous water bodies within a topographic framework of natural levee ridges that extend fingerlike toward the coast. Toward the west, marshes gradually give way to open bays which are partially separated from the Gulf of Mexico by barrier islands.

Elevation in the study area, with the exception of the natural levee ridges and the spoil elevated areas that parallel artificial waterways, is generally less than 5 ft MSL. As a result, most of the area is subject to tidal inundation. Spring tides and wind tides will flood the marshes while storm surges result in flooding of the natural levee ridges.

The general hydrologic setting of the Port Fourchon area is a function of geologic history as it relates to changes in Mississippi River courses, the process of bifurcation and subdelta building, and the resulting topographic forms. Most important in this regard has been the development of distributaries which result in a hierarchy of triangular interdistributary basins, the base of which is open to the Gulf of Mexico and whose sides are formed by relatively high natural levee ridges. On a small scale, each of these triangular basins represents a distinct hydrologic unit which has become dependent on local rainfall for freshwater input and is estuarine in character as a result of water exchange with the Gulf of Mexico.

The general hydrologic structure of the area is shown in Fig. A-14. The Fourchon area is seen to occupy a third-order interdistributary basin formed by bifurcation of a Lafourche-Mississippi distributary, that is, Bayou Lafourche. It is part of a second-order basin contained between Bayous Lafourche and L'Ours which in turn is part of the first-order Salvador-Barataria Basin formed by the Lafourche-Mississippi and the Modern Mississippi River. To the west the Fourchon area is bounded by the secondary basins formed by the natural levee ridges of Bayou Lafourche and Point-au-Chiene.

Hydrologic character of each of the basins, independent of order, is similar in that freshwater input is derived primarily from local precipitation, and runoff is directed away from the higher margins toward the center as a result of natural level gradient and generally southward as a result of overall basin gradient. Flow routes are poorly defined, since most of the basin is occupied by swamps and marshes with numerous interconnecting channels, canals, and lakes. Within each basin, freshwater mixes with waters of varying salinity introduced from the south as a result of lunar or wind tides. Salinity of the incoming water may change as a function of Mississippi River discharges and offshore circulation, and as a function of freshwater release from the upper part of each basin. Limited depth of water bodies causes mixing to be predominantly lateral and results in a wide mixing zone with low salinity gradients. Average salinity distribution is shown in Fig. A-15 by means of a number of iso-halines.

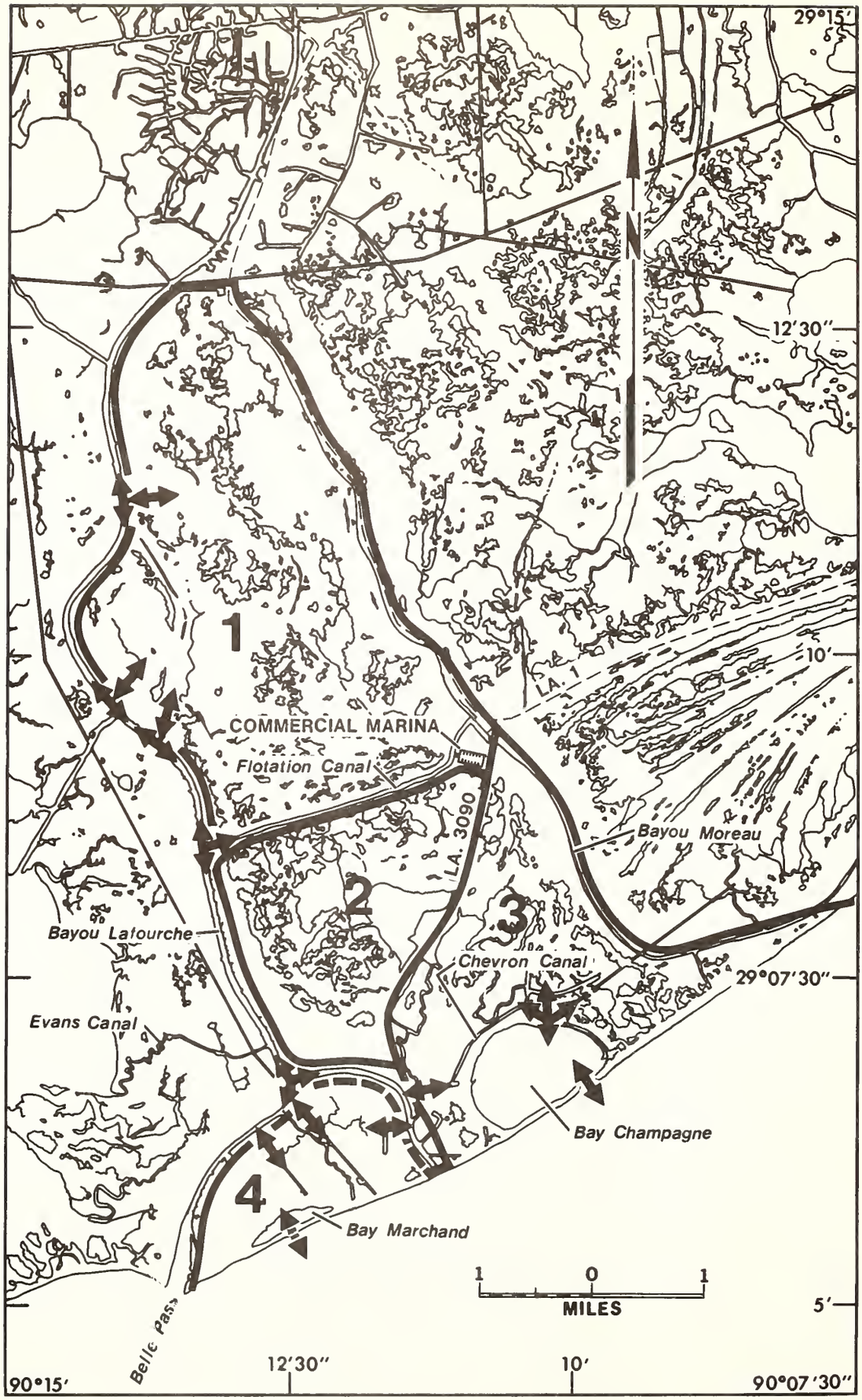


Fig. A-14. General hydrology of the Port Fourchon area.

Fig. A-15. Average salinity distribution across south central Louisiana (see next page for legend).

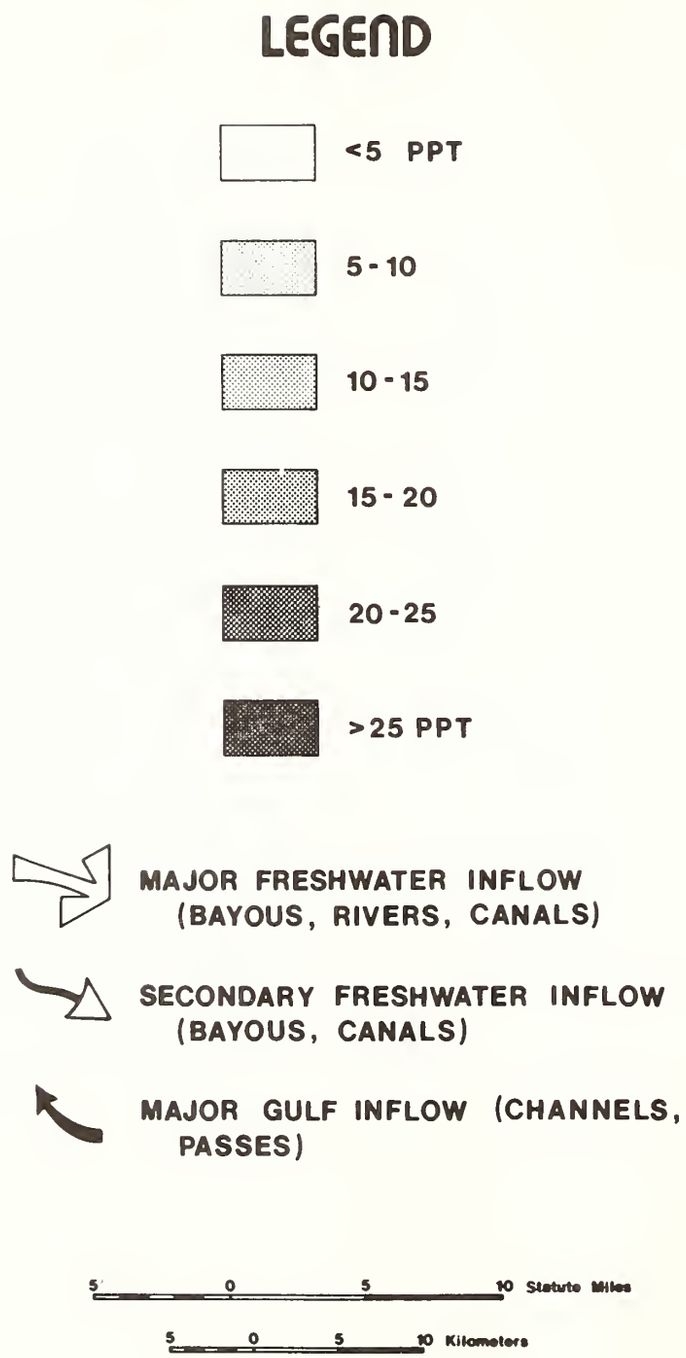


Fig. A-15. Average salinity distribution across south Louisiana (Continued).

Most important with respect to the project area is the interdistributary basin formed by the natural levee ridges of Bayou Lafourche and Bayou Moreau. This basin will hereafter be referred to as the Fourchon Basin. Natural levee ridges of Bayou Moreau separate the Fourchon Basin effectively from the Barataria-Salvador Basin to the east. Natural levee ridges of Bayou Lafourche, on the other hand, are interrupted in a number of places, thus connecting the Fourchon Basin directly with Bayou Lafourche and indirectly with the Timablier Basin to the west of Bayou Lafourche. Exchange of water with the Gulf of Mexico occurs through one or more intermittent tidal passes connecting the Gulf with Bay Champagne and Bay Marchand, and indirectly and continuously through Belle Pass and Bayou Lafourche.

Salinities of Bayou Lafourche are a function of a number of factors. These include: the introduction of freshwater from the Mississippi River at Donaldsonville, salinity of water introduction through canals connecting Bayou Lafourche and the Timablier and Barataria Basins respectively, and Gulf water levels and salinities.

2. Hydrology of the Project Area

To discuss hydrology of the project area, the Fourchon Basin has been divided into four smaller units shown in Fig. A-14, and numbered one through four. Each of these units represents a hydrologic entity with boundaries formed by natural and man-made features.

Unit 1 occupies the northern half of the Fourchon basin. Rigid boundaries occur along the east and south side; on the east is the natural levee of Bayou Moreau and the associated road bed of LA Highway 1 on the south side is a spoil embankment associated with the flotation canal that connects Bayou Lafourche and a commercial marina. To the west the unit is bounded by Bayou Lafourche; exchange of water is possible through a number of tidal creeks. Spoil embankments along Bayou Lafourche have led to partial ponding. The area is characterized by the broken marsh surface and numerous shallow water bodies associated with deteriorating salt marsh.

Unit 2 is part of the project area and is totally impounded by spoil embankments and associated road beds except for one small outlet to the flotation canal. Exchange of water with surrounding water bodies is negligible. The area is almost entirely occupied by shallow waters. As a result of impoundment, water has become brackish.

Unit 3 is a salt marsh basin bounded by spoil and an associated road bed to the west and by the natural levee ridge of Bayou Moreau to the east. Along the south side, it is bounded by a narrow beach ridge which protects it from direct Gulf wave action but which allows exchange of water through a tidal pass into Bay Champagne. The unit represents an estuarine sub-basin within the Fourchon Basin. Most of the area is characterized by salt marsh interspersed with numerous small lakes and tidal channels. Bay Champagne takes up the remaining area.

North-south water movement has been partly interfered with as a result of the Chevron Canal, which is oriented east-west along the north side of Bay Champagne. The canal connects with Pass Fourchon and thus indirectly with Bayou Lafourche. At times, the tidal pass may be closed due to spit building across its mouth. Under such circumstances the Chevron Canal regulates water exchange.

Unit 4 is separated from the Gulf by a low marsh ridge that occasionally is breached. Spoil embankments partly separate the area from Belle Pass and Pass Fourchon with water exchange regulated by intersecting location canals. Spoil deposition has resulted in destruction of most of the original salt marsh. Some marsh remains in the eastern half. Bay Marchand remains just inside the beach ridge along the southern margin, but it is being filled as a result of shoreline retreat. Since Pass Fourchon is closed at its mouth by a dam, water exchange is primarily with water derived from Bayou Lafourche.

In general, the hydrology of Units 1 and 4 is regulated by conditions in Bayou Lafourche that include stage, salinity, and water quality, and by local precipitation and the degree of ponding. Unit 2 is an impoundment, but subject to overflow during high tidal stages. Ponding of local precipitation greatly reduces salinities. Unit 3 may shift from indirect dependency on Bayou Lafourche when tidal passes are closed, to direct exchange with marine waters when Bay Champagne is connected with the Gulf of Mexico. Marine effects can be overriding for all units when storm surges lead to flooding of the entire area.

3. Major Tributaries

Only one major stream, Bayou Lafourche, affects the project area. Bayou Lafourche originates at the town of Donaldsonville and flows into the Gulf of Mexico. Originally a distributary of the Mississippi River, the bayou was separated in 1904 from the Mississippi River by a dam; water is now pumped into the bayou at rates from 100 to 300 cfs with an average of 260 cfs. The length of Bayou Lafourche is approximately 102 mi. Water flow is confined between natural levee ridges but artificial canals provide for exchange of water with adjacent estuarine basins to the east and west. Near the Gulf of Mexico the channel bifurcates into Pass Fourchon and Belle Pass. Pass Fourchon, however, has been artificially closed so that all flow enters the Gulf through Belle Pass. Belle Pass has been enlarged by dredging to a 20 ft by 300 ft channel to improve deep water access as part of the Port Fourchon development program. Additional access work has been the building of jetties at the mouth of Belle Pass.

Bayou Lafourche can be separated into two reaches: An upper, freshwater reach from Donaldsonville to the Intracoastal Waterway, and a lower reach from the waterway to the Gulf which is subject to tidal effects and saltwater mixing. The upper reach is dependent primarily on water introduction at Donaldsonville and water exchange with the Company and Intracoastal Canal. A weir at Thibodaux is for water supply purposes.

Adjacent to the project area, Bayou Lafourche presently has a depth of approximately 10 ft and a width of about 500 ft. The Bayou has been intensively dredged for navigation. Dredging in the reach from Leeville to the Belle Pass was completed in 1963 when a channel of 12 ft by 125 ft was attained. Predicted maintenance frequency of the section was ten years.

4. Other Water Bodies Related to the Study Area

The study area relates indirectly to water bodies of the Timbalier Basin as a result of linkage between the Bay and Bayou Lafourche. Timbalier Bay and its fringing marshes connect with Bayou Lafourche by means of Evans Canal and an unnamed pipeline canal farther north. Both canals are shown in Fig. A-14.

5. Uses of Surface Waters

Use of surface waters in the project area is limited to navigation related to oil and gas industry, commercial fisheries, and recreation. The Bayou Lafourche-Belle Pass channel serves as the main route to the Gulf of Mexico for fishing vessels stationed at the towns along Bayou Lafourche. Many industries serving the well platforms in the Gulf of Mexico are also located along Bayou Lafourche. The channel further gives access to the Gulf for recreational activities such as deep-sea fishing.

Within the project area, there are two more channels that serve navigation. The flotation canal connects Bayou Lafourche with a commercial marina adjacent to LA Highway 1. Pass Fourchon connects Bayou Lafourche with oil and gas storage tanks.

6. Stages, Flows, and Tidal Effects

Because of limited water input, stages in Bayou Lafourche and connected waters of the project area are primarily determined by lunar and wind tides. Average stages in Bayou Lafourche decrease in downstream direction from 5.2 ft at Thibodaux, to 1.1 ft at Leeville to 0.4 ft at Belle Pass. Near the mouth of Bayou Lafourche in the project area, the stage variation averages 1.4 ft. Extreme conditions occur in connection with hurricane passage or landfall. For example, stages associated with hurricane Betsy in September, 1965, ran to approximately 6.5 ft at the mouth of Bayou Lafourche.

Flows in Lower Bayou Lafourche are influenced strongly by wind and tide. Connection with the Barataria and Timbalier estuaries provide for discharge increases over the water input from the Mississippi River at Donaldsonville. Flow measurements reported by Whitehurst (1974) are shown in Table A-4.

Table A-4. Hydraulic data at selected sites.

Mile Number	Site	Cross Sectional Area (ft^2)	$\bar{Q}$ (cfs)	Q max (cfs)	$\bar{V}$ (fps)	V max (fps)
106	3	565	266	544	0.471	0.963
70	14	750	266	544	0.394	0.725
51	22	1550	456	899	0.292	0.580
26	32	2930	533	4770	0.182	1.59

*All minimum flows are 0.0 cfs; All minimum velocities are 0.0 cfs. (ft^2)=square feet; $\bar{Q}$ (cfs)=adverse discharge, cubic feet per second; Q max (cfs)=discharge maximum, cubic feet per second; $\bar{V}$ (fps)=adverse velocity, feet per second; V max (fps)=maximum velocity, feet per second.

Source: Whitehurst, 1974.

7. Tides and Wave Characteristics

Tides affect the coastal area by controlling the rate of mixing of seawater and freshwater in this zone, influencing navigation depths in the sea level canals, and regulating the rate of disposal of waste in the coastal zone. Tides commonly inundate the lower coastal marshes to depths of 12 to 29 in. On the average their speed varies up to 3.5 knots during flood periods and up to 4.3 knots during ebb periods. The mean tidal level is from 0.4 to 1.2 ft, and the mean tidal range is from 0.9 to 2.5 ft. Monthly data on tides along the central Louisiana coast are shown in Table A-5. The normal tide along this coast is diurnal, but strong winds may change its character. Winds modify the tides significantly. During the winter months the marshes are rarely covered as a result of northerly winds of long duration which accompany very low tides. The lowest mean water levels occur from December through March and the highest levels occur in September and October.

The Louisiana coast is known as a low-energy coast in terms of offshore waves. Generally waves along this coast are 3 to 5 ft in height with a period of 4.5 to 6 sec when wind speeds are greater than 10 km/hr. They commonly approach the coastline from the southeast (Table A-6). A previous study (Becker, 1972) implies that during spring and summer the intensity of offshore waves is at its lowest peak but that during fall and winter it increases 2 to 3 times the low intensity. Direction of approach and longshore current velocity are important factors related to the erosion rates of the retreating shoreline of the Port Fourchon area and should be taken into account when considering the placement of structures for shore stabilization, hurri-

Table A-5. Monthly tide levels in feet along the Central Louisiana Coast, 1958-59*.

Month	Mean High Tide	Mean Low Tide	Mean Water Level	Highest Individual Tide	Lowest Individual Tide
January	.39	-.35	.02	1.5	-2.0
February	.56	-.26	.15	1.6	-1.8
March	.60	-.18	.21	1.3	-1.5
April	.78	.09	.43	1.2	- .7
May	1.13	.40	.76	2.4	- .7
June	1.19	.18	.69	1.7	- .7
July	.83	-.06	.39	1.5	-1.0
August	.83	.11	.47	1.6	- .8
September	1.26	.69	.97	2.6	- .2
October	1.06	.39	.72	1.8	- .5
November	.85	.07	.46	1.5	-2.1
December	.37	-.62	-.12	1.4	-2.2
Annual	.82	.04	.43	2.6	-2.2

Source: *From Chabreck and Hoffpauir, 1962; Chabreck, 1972.

cane protection, and navigational improvements. A recent report (Whitehurst and Self, 1974) observed that littoral current moved from east to west (waves approaching from east-southeast to southeast). Wave diffraction was also observed occurring around the jetty at Belle Pass causing recession on the downdrift side and varying shoreline recession immediately west of the channel.

The study concluded that shoreline erosion west of Belle Pass will continue at the present rate from natural processes; and that the 1200 ft dike extension on the proposed west jetty will retard wave action on the remnant island and at the mouth of the north-south canal to the west. It also indicated that the proposed jetty system will offer safety to navigation in and out of Belle Pass at times of rough seas.

Table A-6. Annual wave climate summary for Coastal Louisiana.

Wave Height (feet)	Wave Period (seconds)	Direction From Which Wave is Coming: East	Southeast	South	Southwest	Subtotals
3.0	4.5	13.4%	20.9%	7.5%	5.0%	46.8%
5.0	6.0	8.9%	20.6%	8.7%	7.6%	45.8%
7.0	7.0	1.2%	1.2%	0.8%	0	3.2%
8.5	8.0	1.4%	0.5%	1.5%	0.8%	4.2%
Subtotals		24.9%	43.2%	18.5%	13.4%	100.0%

*The percentages cited are relative to portion of time during the year when wind velocities exceed 10 kilometers/hour. Winds >10 kilometers/hour prevail during 43.3 percent of the year on the average.

Source: Becker, 1972.

F. CLIMATOLOGY

The Port Fourchon area has a humid, sub-tropical, marine climate associated with the latitude of the region and proximity of the site to the Gulf of Mexico.

1. Temperature Distribution

The annual average temperature in the area is 69.2°F; the average temperature in January being 54.9°F, and that of July 80.7°F. The summers are hot with dominant southeasterly winds. Fall weather is warm and generally frost free. During November frontal fogs begin to appear, reducing visibility near the Gulf of Mexico. Winters are usually mild and cool; cold fronts, which move southeastward through the area, are accompanied by high velocity northerly and northwesterly winds. The average frost-free period is 264 days extending from February 27 to November 18. The greatest change in average temperature between successive months occurs from March to April and from October to November.

2. Rainfall Distribution

Precipitation is high, averaging 60.5 in annually (Table A-7). July and August are the wettest months, with average monthly precipitation means of 7.37 in and 6.63 in respectively. Generally the summer and winter seasons are the rainiest. During the summer, moist Gulf air creates almost daily afternoon and evening thunderstorms. Monthly precipitation means for this season are 6.4 in. During the winter precipitation means are 5.2 in. Rainfall during the spring is 4.6 in, slightly less than that during the winter. Although autumn conditions regarding precipitation origins are very much like summer, the monthly precipitation means are 4.5 in.

Precipitation is one of the most important environmental factors in the coastal zone because it controls the area and amount of water available (rainfall excess) for runoff into streams, lakes, swamps, and marshes. Rainfall excess (precipitation minus soil infiltration and evapotranspiration) for the study area expressed as a percentage of annual precipitation is around 27 in (Fig. A-16). The mean annual rainfall excess in the study area is 16 in (Gagliano et al., 1973).

3. Humidity

Humidity is high all yeararound but it is highest during the summer months because of abundant precipitation and because the prevailing winds have a long fetch over the warm surface (Table A-8).

Table A-7. Monthly precipitation in inches (metric equivalents given), Southeast Division.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly Average:											
5.89	4.70	4.90	4.31	4.50	5.27	7.37	6.63	6.40	3.23	3.74	4.96
Monthly Average (cm):											
14.96	11.84	12.45	10.95	11.43	13.39	18.72	16.84	16.26	8.20	9.50	12.59

	Winter(DJF)	Spring(MAM)	Summer(JJA)	Fall(SON)	Annual
Seasonal Average:	5.18	4.57	6.42	4.46	5.16
Seasonal Average (cm):	13.16	11.61	16.31	11.33	13.10

Source: Stone, James, et al., 1973. (Data extracted and derived from National Climatic Summary.)

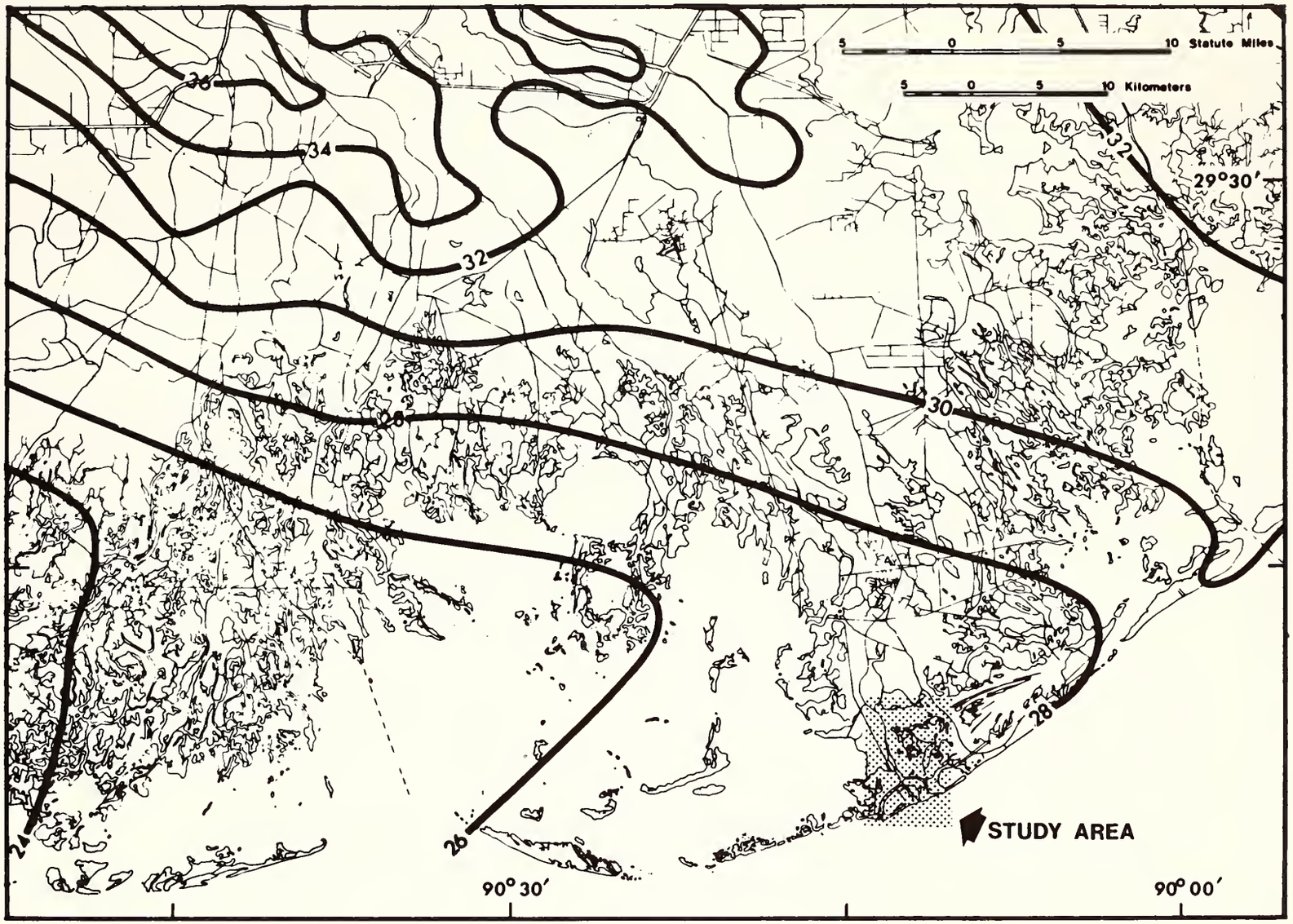


Fig. A-16. Percentage of rainfall excess. South central Louisiana and study area.

Table A-8. Percentage frequencies of relative humidity observations at 6 A.M. and 3 P.M., during midseason months.

Relative humidity in percentage		0-29	30-49	50-69	70-79	80-89	90-100
January	6 A.M.	0	2	12	14	22	51
	3 P.M.	4	25	42	12	9	8
April	6 A.M.	0	2	9	7	22	59
	3 P.M.	6	30	44	9	6	4
July	6 A.M.	0	0	1	2	20	77
	3 P.M.	<0.5	12	48	20	11	8
October	6 A.M.	0	2	9	7	33	49
	3 P.M.	6	33	41	9	5	5

Source: Stone, James, et al., 1973 (New Orleans, 1951-1960).

4. Winds

The two pressure ridges that dominate weather conditions along coastal Louisiana are the "Bermuda high," and the "Mexican heat low." Pressure changes associated with these ridges bring about predominantly easterly winds. In fall and winter they come primarily from the northeast, and although a small percentage of all winds come from the southeast the overall winds shift is still to the north. Spring and summer winds are predominantly from the southeast with only a very small percentage coming from the northeast (Table A-9). The average yearly wind velocity is 9.7 mph. During July 98% of the wind speeds are $\leq$19 mph, and 59% of them are $\leq$9 mph. In September, wind speeds increase over those of July and 11.9% are >25 mph. October wind speeds continue to increase over those of September, 13.7% of which are >25 mph. The increase in wind speed continues into the winter months showing December with 23.1% of the winds being >25 mph. Maximum wind speeds of over 120 mph generated by cyclones and hurricanes can be expected in the study area from late May to early November.

Table A-9. Frequency in percent of winds from various directions in the Gulf of Mexico; A. Monthly Data, B. Seasonal Data.

A. Monthly Data.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
N	19	13	12	10	10	4	4	4	6	13	18	12
NE	16	20	13	18	16	10	10	11	22	34	23	18
E	21	21	20	32	28	30	28	22	33	28	24	22
SE	17	17	27	19	17	23	18	13	13	7	11	16
S	7	10	12	7	6	6	10	8	5	2	6	8
SW	5	3	3	2	3	4	5	7	2	2	2	3
W	5	6	4	4	4	2	4	6	3	2	3	5
NW	10	10	7	7	5	4	4	5	4	4	7	7

B. Seasonal Data.

	Fall	Winter	Spring	Summer
NE	26	18	16	10
E	28	21	27	27
SE	10	17	21	18
NW	5	9	6	4

Source: Stone, James, et al., 1973 (Data extracted from U.S. Navel Weather, 1970).

G. FLOODPLAINS

Flooding in the study area is primarily the result of storm surge from tropical storms. From late May to early November, tropical cyclones and hurricanes may cross the area. These destructive storms flood large areas of the marshes to depths of 10 ft or more. They cause severe damage, and change the environment by raising the salinity of the marshes, destroying wildlife habitat, and causing coastline erosion. During the hurricane season, the average number of tropical storms is 0.76/yr. The overall hurricane probability for any one day is 0.56% in June and July and increases sharply to 0.99% during the early part of August. The study area has been struck (in the period of recorded history) by 10 damaging hurricanes and 22 other hurricanes and tropical storms. The paths of several of these damaging hurricanes are shown in Fig. A-17.

Flooding of the low lying areas at Port Fourchon occurs as a result of the storm surges associated with cyclones. The highest stage of water recorded for the area as a result of a hurricane was 9 ft above MSL at Leeville (north of the study area) in September, 1915.

The area of inundation and conditions associated with the passage of hurricane Betsy in September, 1965 is presented in Fig. A-18. This illustrates how storm surge generation may cause direct flooding as a result of inland propagation of the surge across the marshland, and indirect flooding through upstream propagation of the surge on the Mississippi River.

The proposed site is within the 100 yr floodplain as mapped for U.S. Department of Housing and Urban Development in May 1971 (FIA, 1970).

The project is not presently specifically designed to minimize potential harm to the floodplain, to meet flood-proof standards under the National Flood Insurance Program, or to be in compliance with the Flood Disaster Protection Act. The facility is however set back from the beach area which creates a safety buffer consisting of a natural vegetation area.

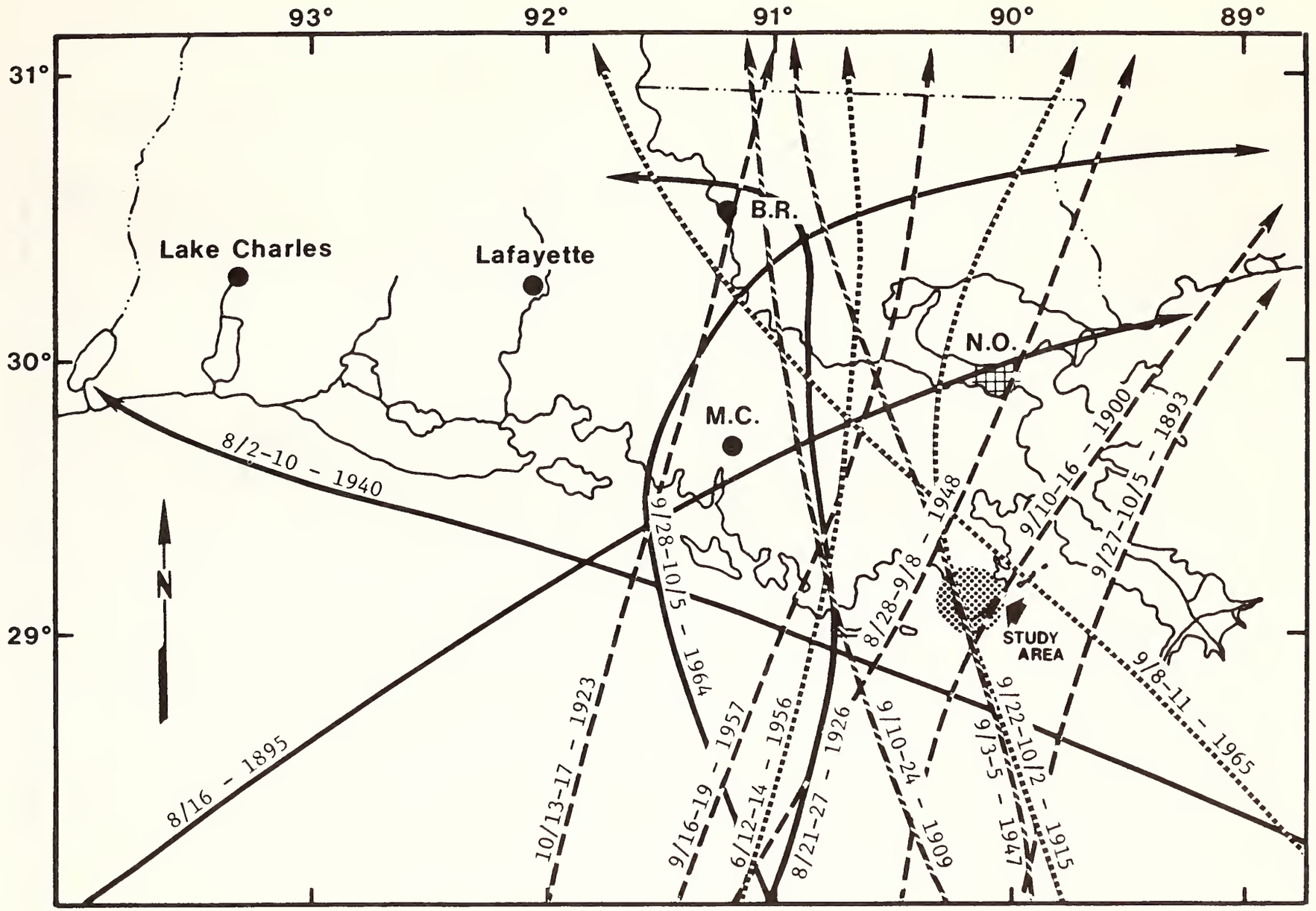


Fig. A-17. Paths of hurricanes in the vicinity of the study area (after U.S. Corps of Engineers, 1972).

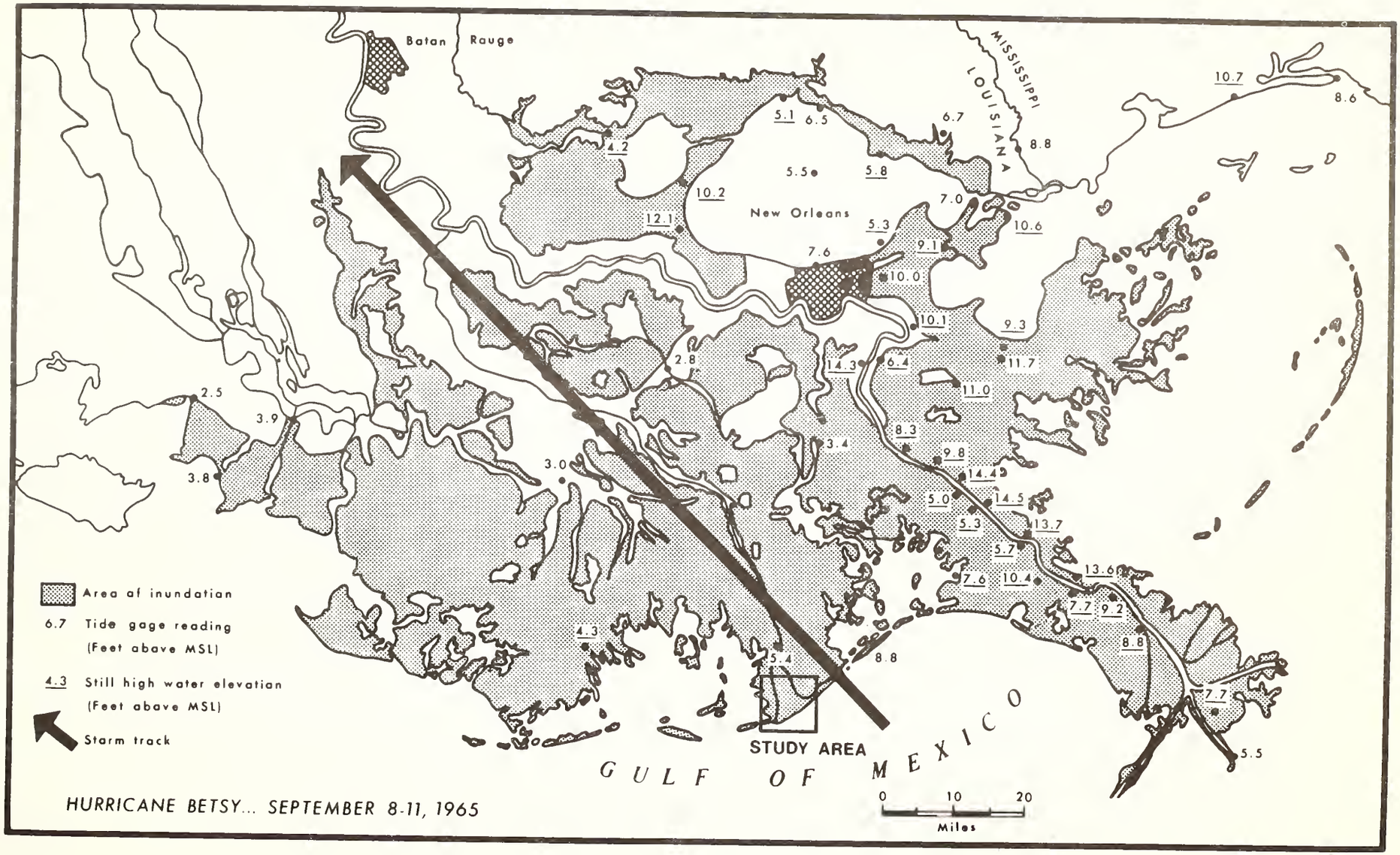


Fig. A-18. Storm surge from Hurricane Betsy, 1965.

H. WETLANDS

With completion of Phase 1 of the Port Fourchon plan the natural vegetation at the site is already undergoing significant changes. Much of the 450 acres planned for development was formerly an intertidal, regularly flooded saline marsh dominated by oyster grass (Spartina alterniflora), a species which occurs in almost pure stands along the Atlantic and Gulf coasts. In Louisiana marshes it is sometimes associated with black rush (Juncus roemerianus), black mangrove (Avicennia nitida), and saltgrass (Distichlis spicata) (Woodhouse, Seneca, Broome, 1974; Chabreck, 1970; Penfound and Hathaway, 1938). Adjacent to the low marsh were the more elevated and better drained narrow levees and minor spoil banks along Bayou Lafourche, Pass Fourchon, and Belle Pass. Terrestrial species including shrubs, herbs, and grasses (Table A-10) occupied these landforms, but there were no large trees (Tobin, 1940; Aero, 1951-52).

An oil tank farm and several small canals and rig cuts were constructed below Pass Fourchon in the early 1950's initiating a change in the indigenous marsh vegetation. Some of the saline marsh was covered by spoil material and shell which either remained bare or was invaded by shrubs and grasses.

In 1967 approximately 2007 acres of this saline marsh were impounded by levees and the area became progressively fresher as salt water interchange was terminated (Monte, 1975). This resulted in deterioration of the interior marsh since Spartina alterniflora required flooding by saline water (Table A-11). A large, shallow lake developed in place of this marsh in the northern three-quarters of the impoundment. The lake bottom was invaded by Widgeon grass (Ruppia maritima), while brackish to intermediated types of vegetation (Spartina patens and Distichlis spicata) began to replace the Spartina alterniflora along the fringes of the lake.

Hurricane Carmen breached the levee in 1974 permitting saline conditions to return temporarily, but the levees were repaired within a few months. Had saline Gulf waters been allowed to resume circulation in the impoundment, the Spartina alterniflora marsh may have rejuvenated. However, under present conditions the impoundment will undergo succession to an intermediate-to-freshwater lake and marsh environment (Whitehurst, 1975).

The western and southern perimeter of this impoundment and the land adjacent to Belle Pass and Pass Fourchon has been receiving large amounts of spoil over the past 10 years. These spoil deposits elevated the land mass, killed the established vegetation through siltation, and initiated a transitional phase. Normal succession on these spoil deposits is expected to culminate in a terrestrial species association (over 60% not wetland species), including some bottomland hardwoods (Monte, 1976). By the time of field reconnaissance in January 1976 a great diversity of species including shrubs, grasses, and herbs already covered the spoil sites and only a few areas remained unvegetated (Fig. A-19). As expected, no vegetation grew in the project area where the land had been paved with shell for roads, parking lots, houses, and other industrial uses (Fig. A-20, A-21, and A-22).

Table A-10. Plants associated with environments located within the Port Fourchon complex.

Common Name	Scientific Name	Mangrove	Mangrove & Marsh	Marsh	Low Spoil	High Spoil	Beach Dunes	Fresh Water
Black mangrove	Avicennia nitida	D	C	P	P		P	
Black willow	Salix migra					P		P
Bushy beardgrass	Andropogon glomeratus				C	C		
Cat-tail	Typha sp.							C
Eastern baccharis	Baccharis halimifolia				C	D		
Flatsedge	Cyperus sp.				P	P		
Glasswort	Salicornia bigelovii			P	C	C	P	
Glasswort	Salicornia virginica				C	P	P	
Goldenrod	Solidago sp.				P	P	P	
Marsh elder	Iva frutescens				P	D		
Oyster grass	Spartina alterniflora	P	C	D	P			
Palmetto	Sabal minor					P		
Pennywort	Hydrocotyle sp.				P			
Railroad vine	Ipomoea pes-capre				P			
Rattle bush	Sesbania sp.					C		
Roseau cane	Phragmites communis				P	P		
Salt grass	Distichlis spicata	P	P	C/D	C	P	P	
Saltwort	Batis maritima	P	P	P	P			
Sandrush	Fimbristylis castanea				P	C	C	
Sea-oxeye	Borrichia frutescens				P	P	P	
Sea purslane	Sesuvium sp.				P	P	P	
Wax myrtle	Myrica cerifera					P		
Widgeon grass	Ruppia maritima							D
Wire Grass	Spartina patens		P	P/D	P	P	P	P

D = Dominant C = Common P = Present at Times

Source: Coastal Environments, Inc. field survey.

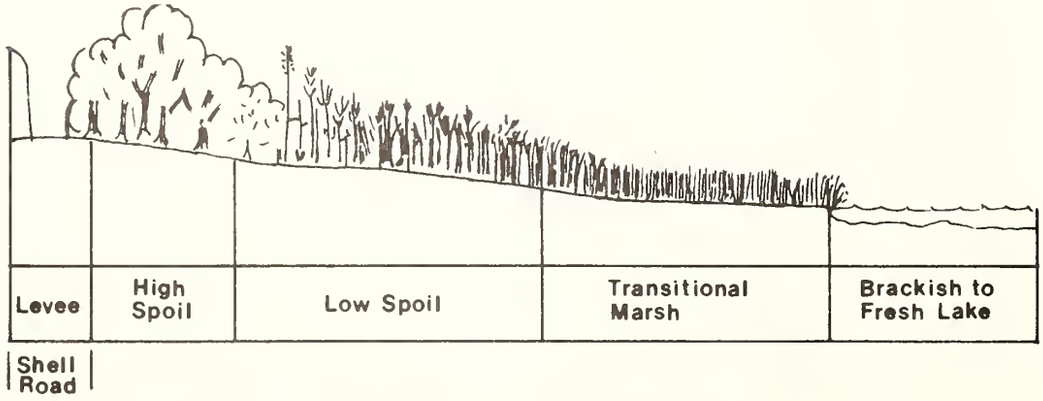
Table A-11. Saline marsh as affected by spoil banks within the impounded area.

	1957		1973		Percent
	Square Miles	Percent	Square Miles	Percent	Change
Spartina	6.63	71	1.62	18	-53 = Change in species
Shrubs	-		0.81	9	+ 9 composition, especially
Grasses	-		0.84	9	+ 9 Ruppia
Ruppia	-		1.96	21	+21
Salt Flat+	-		0.26	3	+ 3
Herbs and Shrubs	-		0.44	5	+ 5
Mangrove	-		0.33	<1	+ 1
Sa.* Dead	-		1.32	14	+14
Urban°	-		0.05	<1	+ 1
Aquatics	-		1.96	21	+21 = aquatic gain
Land	6.63	71	5.37	58	-13 = land loss
Water	2.70	29	1.91	21	- 8
Total	9.24	100	9.24	100	

* Spartina
° Construction Sites
\+ Salt Flat = Unvegetated Spoil Sites

Source: Monte, 1975.

Fig. A-19. Impounded area in Port Fourchon. Shrub grass, herb community invading spoil deposited over former saline marsh.



High Spoil	Low Spoil	Transitional Marsh	Brackish to Fresh Lake
MARSH ELDER	GOLDEN ROD	SALT GRASS	WIDGEON GRASS
EASTERN BACCHARIS	SALT WORT	OYSTER GRASS	
BEARD GRASS	GLASS WORT		
GOLDEN ROD	CATTAIL		
RATTLE BUSH	ROSSEAU CANE		
WAX MYRTLE	WIRE GRASS		
SALT WORT	SALT GRASS		
GLASS WORT	OYSTER GRASS		
CATTAIL			
WIRE GRASS			
SALT GRASS			

Fig. A-20. Schematic diagram illustrating morphological environments and related vegetation associations.

Fig. A-21. Spoil fill being prepared for Port Fourchon development.

Fig. A-22. Port Fourchon beach. Erosion of the shoreline is resulting in reworking of the sand & shell beach and the destruction of vegetation (black mangrove).

The beach along the southern perimeter of the Port Fourchon complex is approximately 250 ft wide and consists of reworked sand and shell. This area is undergoing rapid erosion (Dantin, Whitehurst, Durbin, 1974; Fig. A-22). The beach material is being moved inland by normal wave action and storm surges and is covering the interior marshland, natural levees, and spoil sites. Small dunes back of the beach are covered by beach grasses intermixed with the pre-existing marsh and natural levee and spoil vegetation. A dense stand of mangrove grows behind the beach adjacent to Pass Fourchon and along the blocked tidal channel which bisects the southern portion of the Port Fourchon complex. Scattered mangrove also occurs in the Spartina alterniflora marsh surrounding Bay Marchand.

There are no direct economic or commercial uses for the vegetation in the vicinity of the planned complex. However, the marshlands and estuarine areas are indirectly of great economic value. The exact monetary value (of a marsh land) per acre is difficult to access, although Gossalink, Odum, and Pope (1974) derived a figure of $4000 per acre per year "Based on the gross primary productivity (in energy terms) of the natural marsh using a conversion ratio from energy to dollars based on the ratio of gross national product to national energy consumption." The value of spoil bank vegetation has not been intensively researched but it is believed to be approximately four times less productive than a saline marsh (Young, Odum, Day, Butler, 1974).

In general, the vegetation of a salt marsh acts as an agent for controlling erosion by absorbing and dissipating wave and tidal energy. It also serves as a sediment trap, storm buffer, wildlife habitat, and estuarine nursery (Lagna, 1975). Spartina alterniflora marshes are an important component of any estuarine ecosystem for they possess high rates of primary production, and provide for energy flow and nutrient cycling. Their annual primary production in southern climates such as Louisiana is as high as 2960 g dry wt/m^2/yr streamside and 1,484 g dry wt/m^2/yr 50 m inland. These high rates place the marshes among the most productive systems on earth (Broome, 1973). Detritus washing from these marshes constitutes one of the 5 major primary food sources for estuarine organisms (Walker, 1973), many of which are ultimately harvested by man. The extremely high primary productivity of Louisiana marshland is largely responsible for this portion of the Gulf of Mexico being called the "fertile fisheries crescent" (Gunter, 1967).

Louisiana's saline marshes are of value to fur mammals and waterfowl in that they moderate the effect of tides and salinities. This provides a buffer zone which protects the more desirable animal habitats further inland (Palmisano and Chabreck, 1972).

The only direct recreation or aesthetic use for the vegetation resources in this area would be by those who engage in collecting plants or who wish to study an area undergoing dynamic changes resulting from the actions of both man and nature. The well-developed grove of mangroves along the beach and tidal channel and the beach vegetation possess significant aesthetic value for those who appreciate this type

of environment. Port Fourchon provides one of the few easily accessible areas for observing these particular associations along the Louisiana coast; however, no rare or endangered plant species are known to exist in this area (McGinnis, et al., 1972). A list of the vascular plants present in the area can be found in Table A-12.

Table A-12. A list of vascular plants present in the study area.

Common Name	Scientific Name
Bushy beardgrass	Andropogon glomeratus
Black mangrove	Avicennia nitida
Eastern baccharis	Baccharis halimifolia
Saltwort	Batis maritima
Sea-oxeye	Borrichia frutescens
Flatsedge	Cyperus sp.
Salt grass	Distichlis spicata
Sandrush	Fimbristylis castanea
Pennywort	Hydrocotyle sp.
Railroad vine	Ipomoea pes-caprae
Marsh elder	Iva frutescens
Wax myrtle	Myrica cerifera
Roseau cane	Phragmites communis
Palmetto	Sabal minor
Glasswort	Salicornia bigelovii
Glasswort	Salicornia virginica
Black willow	Salix nigra
Rattle bush	Sesbania sp.
Sea purslane	Sesuvium sp.
Goldenrod	Solidago sp.
Oyster grass	Spartina alterniflora
Wire grass	Spartina patens
Cattail	Typha sp.

Source: Coastal Environments, Inc. field survey.

In summary, the study area serves as wildlife habitat for migratory waterfowl and other wetland fauna (See Section 1, K). The Greater Lafourche Port Commission has received three U.S. Army Corps of Engineers permits as follows:

Date	Permit Number	Description of Action
October 7, 1974	LMNOD-SP	Dredge Belle Pass to 20 ft
	(Gulf of Mexico) 1242	Install and maintain a jetty

Date	Permit Number	Description of Action
August 16, 1976	LMNOD-SP (Pass Fourchon) 6	Dredge a channel and slip Install and maintain a road Fill in Pass Fourchon
July 13, 1977	LMNOD-SP (Bayou Lafourche) 702	Dredge in an area and install and maintain rip-rap and fill

There is no state agency which permits activities in the wetlands. The Louisiana Stream Control Commission, the Louisiana Air Control Commission, and the Louisiana Health and Human Resources Administration require permits for discharges into water and air and design of sanitation facilities, but they do not control land use.

I. WILDLIFE HABITAT

1. General Wildlife Description

The Port Fourchon project area may be described as a modified saline marsh zone at the mouth of Bayou Lafourche with a beach front on the Gulf of Mexico. The marshlands in the project area have undergone considerable change as a result of spoil deposition and impoundment. A large area (approximately 2284 acres) of former marshland in the northern two-thirds of the project area (above Pass Fourchon), which formerly contained large marsh lakes (as shown on the 1953 U.S.G.S. 7.5 minute quadrangle) has been converted into a single, shallow, impounded lake fringed with spoil deposits. A smaller marsh area (1300 acres) south of Pass Fourchon, vegetated mostly by oyster grass (Spartina alterniflora) and black mangrove (Avicennia nitida), has likewise been affected by spoil deposition, although the interior of this marsh zone still receives tidal interchange with the Gulf via Bayou Lafourche, the Tennessee Gas Transmission Canal, and small, natural channels. The total area of functional marsh (approximately 600 acres) is, however, small as compared to the modified areas.

Terrestrial wildlife habitats occurring in the Port Fourchon project area consist of: 1) the Gulf beach, 2) saline marshes, and 3) spoil deposits. Certain animal species utilizing these habitats may be closely associated with one habitat type, while other species, which are less exacting in their habitat requirements, may be spread over all habitat types. Terrestrial wildlife species occurring in the project area are discussed below under a) and b).

Aquatic habitats in the project include: 1) the surf zone of the Gulf beach, 2) the jetties at the end of Belle Pass, 3) Bayou Lafourche, 4) small canals and bayous arising from Bayou Lafourche and entering the marsh, 5) the marsh proper, and 6) the large, impounded brackish water lake along Highway 3090. Aquatic animals, including fish and shellfish, and animals closely associated with or dependent upon aquatic habitats, such as shore birds, wading birds, waterfowl, and fur-bearing mammals, are the predominant fauna in the project area which may best be described as an estuarine environment. Aquatic animals occurring in the project area are discussed in more detail below.

a) Game and Fur Mammals

Virtually the only game species of mammal occurring in the project area is the swamp rabbit (Sylvilagus aquaticus). Rabbit pellets were numerous in both marsh and spoil bank zones in the project area, indicating an abundance of swamp rabbits in these habitats. The Louisiana Wild Life and Fisheries Commission, in a wildlife survey of Lafourche Parish (1975), estimated the rabbit population in salt marsh habitats as one rabbit per ten acres of marsh. It is not known to what extent rabbits are hunted in the project area. The Wisner Wildlife Management

area (adjacent to the project area) has provided an average of 600 man/days of recreation in the form of rabbit hunting in past years (Table A-13).

Other game mammals, such as deer and squirrels, are absent from the project area because of the lack of suitable habitat. The raccoon (Procyon lotor) is hunted as a game animal in forested areas of Louisiana, but it is unlikely that raccoon hunting occurs in the project area.

Fur-bearing mammals which utilize salt marsh habitats include muskrats (Ondatra zibethicus), nutria (Myocastor coypus), mink (Mustela vison), raccoons (Procyon lotor), and otters (Lutra canadensis). All five of these species may occur in the project area. Although there is some limited fur trapping in the area, salt marshes are not major trapping grounds and most trapping efforts are carried out in other marsh types (i.e., fresh, intermediate, and brackish marshes). It is also in these other marsh types that the above-mentioned furbearers reach their highest population numbers. Saline marshes may periodically contain good numbers of muskrats, however, the quality of muskrat pelts (as well as those of other furbearers) from salt marsh areas is low, a factor which further reduces the value of salt marshes as fur-producing areas.

b) Non-Game Mammals

No systematic survey of the non-game mammals of the project area has been conducted. Terrestrial mammals which are likely to occur here, however, include the nine-banded armadillo (Dasypus novemcinctus) and the marsh rice rat (Oryzomys palustris). Certain bats, especially the seminole bat (Lasiurus seminolus), are probably nocturnal feeders on insects over the marshes in and near the project area.

The Atlantic bottle-nosed dolphin (Tursiops truncatus) is common in the nearshore waters on the Gulf of Mexico and inner bays near the project area, and very likely enters Bayou Lafourche on occasions. Other marine mammals may sometimes be observed offshore in the deeper Gulf waters or found washed upon beaches. On August 19, 1939, following a hurricane, Dr. George H. Lowery, Jr. of the L.S.U. Museum of Zoology found 49 short-finned pilot whales (Globicephala macrorhyncha) dead on the beach "several hundred yards west of Pass Fourchon on the delta of Bayou Lafource" (Lowery, 1974b).

c) Game Birds

Waterfowl and rails are probably the only game birds occurring in the project area in sufficient numbers to attract hunter interest. The impounded, shallow lake along Highway 3090 appears to be utilized heavily by waterfowl as a feeding area. This lake is also heavily hunted by duck hunters in the winter months as evidenced by the large number of

Table A-13. Recreation provided in past years and for 1971-1979 Wisner Wildlife Management Area.

Hunting	Average man days/year in past years	Estimated average man days/ year for 1971-1979					Five year Total
		1	2	3	4	5	
Ducks & geese	800	805	850	875	900	925	4,375
Rabbits	600	625	650	675	700	725	3,375
Rails & snipe	500	525	550	575	600	625	2,875
Other Endeavors							
Fishing	20,000	21,500	21,000	21,500	22,000	22,500	107,500
Crabbing	4,000	4,050	4,100	4,150	4,200	4,250	20,750
Shrimping	4,500	4,550	4,600	4,650	4,700	4,750	18,600
Boating	1,000	1,050	1,100	1,150	1,200	1,250	5,750
Skiing	125	130	135	140	145	150	700
Bird Watching	100	105	110	115	120	125	575
Swimming	300	310	320	330	340	350	1,320
Camping	500-1,000	800	850	900	950	1,000	4,500

Source: Louisiana Wildlife and Fisheries Commission.

duck blinds erected in the lake. The major species of waterfowl which occur in the project area include coots, mallards, pintails, gadwalls, American wigeons, shovelers, green-winged teal, blue-winged teal, mottled ducks, lesser scaup, and ring-necked ducks. All of these birds are migratory except for the mottled duck which is a year-round resident in the coastal marshes. Other species of waterfowl may be present at times, but they are less common.

Clapper rails (Rallus longirostris) are common in the salt marshes in and near the project area. These birds were seen in abundance in the black mangrove-oyster grass marsh between Pass Fourchon and Belle Pass during field trips to the project area. Rails are not usually subjected to heavy hunting pressure in Louisiana and most rails are killed incidentally by duck hunters. The clapper rail is a year-round resident in the more saline areas of the coastal marshes. The king rail (Rallus elegans) is also a permanent resident which prefers less saline habitats. Populations of both species are increased in the winter months in Louisiana by the arrival of migrant birds from more northerly areas. The Virginia rail (Rallus limicola) and the sora (Porzana carolina) are migratory game birds which occur in the Louisiana marshes in the winter months. Like the king rail, the Virginia rail and the sora are most common in freshwater habitats, including marshes, and are thus probably uncommon in the project area.

d) Non-Game Birds

A complete listing of all the various birds which occur seasonally and permanently in the project area would require at least a one-year period of observation. Certain bird groups, however, are conspicuous and are characteristic of the different habitats occurring in the project area. These groups of birds include (a) fishing birds, (b) shore birds, (c) marsh birds, (d) wading birds, (e) raptors, and (f) perching birds. Another group, the waterfowl, have been dealt with in the section on game birds.

(1) Fishing Birds (Gulls, Terns, Skimmers, Pelicans): Gulls and terns are abundant in the project area, occurring anywhere along watercourses, ponds, lakes, and offshore. The most commonly observed gulls are herring gulls (mostly immatures), laughing gulls, and ring-billed gulls; while Forster's tern, the royal tern, and the Caspian tern are the most frequently observed terns. Other gulls and terns may be expected to occur in the project area, but are less common. The black skimmer frequents the Gulf beaches and is a common permanent resident in and around the project area.

The native Louisiana population of its state bird, the brown pelican, became extinct in the state in the early 1960's. Beginning in 1968, and for several subsequent years, the Louisiana Wild Life and Fisheries Commission introduced brown pelicans obtained from South Florida onto Grand Terre Island approximately 25 mi east of the

project area. Fortunately, these birds prospered and reproduced so that by 1973 the estimated population was about 400 birds, occurring from the Chandeleur Islands west to East Timbalier Island in Terrebonne Parish (Lowery, 1974a). More recently, however, in 1975, adult brown pelicans near the Mississippi River Delta suddenly began to die off for no apparent reason, although cumulative poisoning by concentration of chlorinated hydrocarbon pesticides in body fats has definitely been linked to the initial decline of the pelicans and has been strongly suspected in the most recent die-offs.

Thus, the brown pelican, an endangered species, is leading a precarious existence in Louisiana and is entitled to careful consideration whenever any project of man encroaches on its habitat. The project area -- especially the Gulf beach, the nearshore Gulf of Mexico, and the rock jetties at the mouth of Belle Pass -- is undoubtedly utilized by brown pelicans as a feeding area.

The white pelican, which is a winter resident in Louisiana, occurs in and near the project area. The large, brackish-water impounded area alongside Highway 3090 serves as a feeding area for white pelicans. The white pelican is in much better shape, population-wise, than the brown pelican; however, its numbers have been declining in some areas of its range and the bird is included on the National Audubon Society's 1976 "Blue List" of declining birds.

(2) Shore Birds: Shore birds include such small birds as plovers, sandpipers, and others which are frequently seen scurrying along the wave-washed beach zone in search of food. They also utilize marsh habitats. A list of shore birds observed near the project area during the Louisiana Offshore Oil Pipeline study (LOOP Inc., 1974) is given below:

Piping Plover (Charadrius melodus)
Semipalmated Plover (Charadrius hiaticula semipalmatus)
Wilson's Plover (Charadrius wilsonia wilsonia)
Black-Bellied Plover (Pluvialis squatarola)
Ruddy Turnstone (Arenaria interpres morinella)
Willet (Catoptrophorus semipalmatus)
Dowitcher (Limnodromus sp.)
Semipalmated Sandpiper (Calidris pusilla)**
Western Sandpiper (Calidris mauri)**
Sanderling (Calidris alba)
Dunlin (Calidris alpina)
Killdeer (Charadrius vociferus vociferus)
Avocet (Recurvirostra americana)

(Helga Cernicek, Observer)

(3) Marsh Birds: Seaside sparrows, grackles, and red-winged blackbirds are common in, and quite characteristic of, the marsh habitat in and near the project area. Rails, already discussed as game birds, also utilize this habitat.

**Dominant Species

(4) Wading Birds: Herons and egrets are numerous in the project area. Great egrets and snowy egrets were very frequently observed on field trips to Port Fourchon. Also common were Louisiana herons, green herons, and great blue herons. Other birds in this group which were not observed, but which are certain to occur there include the black-crowned night heron, white ibis, white-faced ibis (all three of which are listed on the National Audubon Society's Blue List of declining birds for 1976), the American bittern, and the least bittern.

Wading birds were observed in most wet sites on the project area. They were absent from the Gulf beach, however, and were most numerous in the marsh areas.

(5) Raptors: Raptors (birds of prey) were uncommon in the project area. Most hawks and owls are associated with forested habitats. The marsh hawk (listed on the National Audubon Society's Blue List of declining birds for 1976) occurs in marsh habitats and one marsh hawk was observed in the project area near Bay Marchand. Several American kestrels (sparrow hawks), also on the same Blue List, were observed along Louisiana Highway 1 between the project area and Grand Isle. The osprey, on the same Blue List, may occasionally visit the project area, especially to fish in the shallow impounded lake. The peregrine falcon and the bald eagle could also presumably occasionally utilize the project area as a feeding area. These species are discussed in the section on endangered species.

(6) Perching Birds: The perching birds (Order Passeriformes) include a great array of birds of types familiar to most people, such as swallows, wrens, warblers, vireos, and sparrows. Many familiar town birds like mockingbirds, cardinals, blue jays, purple martins, and others are members of this group. Many of these birds are present in the project area only temporarily during migration. Highest land areas, such as spoil banks where much shrubby vegetation occurs, are used by passerine birds. These areas are particularly important during northward migration in the spring months when for many migrants such areas are the first opportunities for landfall after cross-flight of the Gulf of Mexico. Lowery (1974a) has pointed out, however, that utilization of such areas as cheniers by spring trans-Gulf migrants is only important during inclement weather. During good weather most migrants fly inland before making landfall. Although the woody cheniers are probably more valuable areas to spring migrants in this respect, spoil banks undoubtedly also serve as resting and feeding areas.

e) Herptiles (Reptiles and Amphibians)

The saline nature of much of the habitat found in the project area precluded its utilization by most reptiles and amphibians. Only two species of reptiles - the Gulf saltmarsh snake (Natrix faciata clarki) and the diamondback terrapin (Malaclemys terrapin) are regularly found in salt marsh environments. One amphibian - the Gulf Coast toad (Bufo

valliceps valliceps) - is sometimes encountered on Gulf beaches. Any of these three species may possibly occur in the study area. Certain sea turtles may occasionally be found in the Gulf of Mexico near the project area.

f) Insects

Little information is available concerning insects in Louisiana salt marshes. Mosquitoes, however, are periodically abundant. The predominant mosquitoes in marshes of the southeastern United States are Aedes sollicitans and Aedes taeniorhynchus. Biting midges (Culicoides sp.) also occur in salt marsh habitats (LOOP, Inc., 1974). The aquatic larvae of these insects may be utilized as food by marine organisms.

g) Usage

There is no data available on usage of the project area by hunters and other recreationists. Usage of the adjacent Wisner Wildlife Management Area for various recreational activities is given in Table A-13. The major recreational activity derived from the terrestrial wildlife resources of the project area appears to be duck hunting, judging by the number of duck blinds on the impounded lake. Probably little, if any, hunting for rabbits or rails occurs within the project area. Although a few trappers work the area, most fur trapping is done in other, less saline areas, where pelt quality is better and furbearers are more abundant. No data is available on the extent to which the project area is used for non-consumptive recreational activities such as bird-watching, nature study, etc., which are based in whole or in part on the terrestrial wildlife resources.

h) Public Hunting Areas

The project area serves as a public hunting area, especially for duck hunters. Hunting recreation is further available on the adjacent 26,000 acre Wisner Wildlife Management Area. Game species most often sought on the Wisner Tract included waterfowl, rails, gallinules, snipe, and rabbits. Usage of the Wisner Area for various recreational activities is given in Table A-13.

i) Rare and/or Endangered Species

Endangered species which may occasionally utilize, fly over, or visit the project area include the eastern brown pelican, the southern bald eagle, and the peregrine falcon. The American alligator currently designated as "threatened," occurs near enough to the project area to deserve consideration, but probably does not occur within the project area because of lack of suitable habitat conditions.

The eastern brown pelican occasionally feeds in the project area, especially near the Gulf beach and the jetties at the mouth of Belle Pass. It was observed near this area during the LOOP study (LOOP, Inc., 1974). No pelican nesting sites occur, however, in the project area. Before the 1976 die-off, nesting occurred on islands in the Timbalier Chain and on Queen Bess Island in Barataria Bay, 15 mi to the northeast (Aycock, 1976).

The southern bald eagle occurs in south Louisiana where it nests in the wintertime. Eagles are most often seen in and near wooded areas where they build their huge nests near the tops of tall trees. Eagles feed heavily on fish and thus their nests are usually located near lakes or other large bodies of water. The absence of wooded areas or trees near the project area precludes the use of this area by eagles as a nesting habitat. Eagles may occasionally, however, fly over the project area in quest of food. It is probable, though, that the project area is not nearly so valuable as a feeding area for eagles as the further inland bodies of water flanked by tall trees. The nearest bald eagle nest is approximately 40 mi away (Aycock, 1976).

The peregrine falcon also occurs in Louisiana in the winter and spring months. Lowery (1974a) states that the peregrine falcon is now only likely to occur in the coastal region where it preys on gulls, terns, and ducks. The project area does probably on occasion serve as a feeding area for peregrine falcons, but there are no reports of recent origin of the peregrine falcon in this area.

The American alligator (Alligator mississippiensis) was listed as an endangered species on the U.S. List of Endangered Fauna of May, 1974. Presently, the alligator is not an endangered species in this state because of the large populations of these reptiles that are encountered in many areas of the state's wetlands. The alligator is primarily an inhabitant of fresh to slightly brackish water, and only occasionally ventures into more saline areas for short intervals. The project area is thus not a primary alligator habitat.

In addition to the species discussed above, the birds listed below may occur in the project area and are listed in the Blue List for 1976 published by the National Audubon Society (American Birds, December, 1976). These birds are reportedly declining in numbers either in restricted areas or throughout their range.

White Pelican (Pelecanus erythrorhynchas)
Reddish Egret (Dichromanassa rufescens)
White-faced Ibis (Plegadis chibi)
White Ibis (Endocimus albus)
Black-crowned Night Heron (Nucticorax nycticorax)
Marsh Hawk (Circus cyaneus)
Osprey (Pandion haliaetus)
Loggerhead Shrike (Lanius ludovicianus)

Three sea turtles - the Atlantic Hawksbill Turtle (Eretmochelys imbricata), the Atlantic Ridley Turtle (Lepidochelys kempi), and the Atlantic Leatherback Turtle (Dermochelys coriacea) - are included on the United States List of Endangered Fauna published by the U.S. Department of the Interior (1974).

2. Aquatic Ecology

Due to its location at the mouth of Bayou Lafourche on the Gulf of Mexico, the Port Fourchon project area may perhaps best be described in terms of the marine-derived aquatic fauna present in its bayous, canals, lakes, and marshes. Two of the most productive estuarine areas in the United States occur immediately to the east and to the west of the project area; they are the Caminada-Barataria and the Timbalier-Terrebonne estuarine systems respectively. Bayou Lafourche is hydrologically connected with both of these systems and serves as a passageway for the movement of marine organisms into and out of the estuarine areas.

The importance of estuaries to Gulf of Mexico fisheries is well-recognized. Many commercial and sport fish and shellfish stocks are dependent on estuaries during part or all of their life cycles. Commercial shrimp stocks in the Northern Gulf provide a typical example of temporary utilization of estuaries as nursery areas. Adults spawn offshore in deeper waters of the Gulf of Mexico. Eggs hatch offshore, the larval shrimp mature through several stages, and the postlarvae migrate or are carried by currents into the inshore estuaries where they feed and further develop before returning again to the Gulf. Similar life history patterns are known for blue crabs, menhaden, croakers, and other important commercial fishery stocks.

Other marine organisms, including oysters, speckled trout, and many small fishes and crustaceans which are important as food for larger, commercial species are completely estuarine dependent; they live out and complete their life cycle within estuaries.

Prior to the substantial modifications of the terrain by spoil deposition, the Port Fourchon project area was a saline marsh which was periodically inundated by the tides. The marsh vegetation -- primarily oyster grass (Spartina alterniflora)-- growing in the area annually looses a portion of leaves, stems, and other plant parts which accumulate on the marsh floor. Some of this detrital material is eventually flushed from the marsh by precipitation runoff and tidal action into surrounding lagoons, bayous, and lakes where it is subject to further decomposition by physical and biological processes. Detritus particles in the water form a substrata for the attachment of various microscopic organisms such as bacteria, fungi, protozoans, nematodes, and rotifers, as well as organic molecules which may adhere to the surface of the particles. Bacteria and fungi act to further decompose the detrital material, while the small animals present appear to only use it as a substrate.

Detritus particles, along with the associated microbiota, are consumed by a wide variety of marine organisms, including zooplankton, benthic invertebrates, and fishes. The exact role of particulate organic detritus in the nutrition of estuarine organisms is not clearly understood. It is thought that the microbiota and organic molecules attached to the particles are more important in nutrition than the particles are themselves and that these components probably also account for much of the protein content of well-decomposed particulate detritus in estuaries (Odum and de la Cruz, 1967). Many estuarine

organisms which reportedly feed on detritus may do so only incidentally, as in the case of bottom feeding fishes which may ingest some settled particulate matter along with more regular items of their diet. It is possible, however, that such fishes do derive some food value from the detritus so ingested. Other organisms, including many filter-feeding forms, ingest organic detritus particles in quantity, however, and detritus abundance has been correlated with peaks in biomass of zooplankton (Darnell 1967; Day et al., 1973). Carnivorous fishes which do not consume detritus eat other organisms which do. Thus, Odum and de la Cruz (1967) have stated that the major energy flow between autotrophs (plants) and heterotrophs (animals) in estuaries is by way of detrital food chains rather than by grazing food chains because "only a small portion of the net production of the marsh grass is grazed while it is alive."

The ecological processes discussed above are still operative in the project area today although the value of the marshes inside the project area has been diminished by spoil deposition, channel dredging, creation of impoundments by surrounding areas with spoil, and damming of channels. The marshes inside the project area, because of these modifications, are no longer freely flooded and drained by tidal action resulting in the reduction of the export of detritus to the estuaries. Certain marsh areas in the lower part of the project area, although considerably affected by spoil deposits, still function in a near normal manner, because of a hydrologic connection with Bayou Lafourche by way of the Tennessee Gas Transmission Canal and a small bayou. In the northern part of the project area, however, the marsh has been surrounded by spoil deposits on the south, west, and north, and by LA Highway 3090 on the east. Thus an impounded lake has been created which has little or no water exchange with the outside area. The impounded lake covers an area that was formerly occupied by several large and small marsh lakes and ponds which were intricately connected and drained by numerous small, tidal channels. Maturing estuarine fishes and shellfishes were free to move into and out of the area. Transport of detrital material from marshes within the area was not interfered with. Impoundment of the area by encirclement with spoil material has raised water levels over the marsh, permanently flooding and killing the marsh grasses. Salinity in the impoundment has decreased due to dilution by rainfall. Movement of aquatic organisms and materials into and out of the area has stopped due to spoil encirclement and damming of channels. The impounded area has been shut off from the surrounding estuary and, although it now has some importance as a feeding area for waterfowl, much or all of its function as a nursery area for estuarine organisms has been lost.

a) Fishes

Although no systematic collection of fishes and other aquatic organisms has been made (to our knowledge) in the project area, the area is close enough to well studied areas of the Louisiana coast to suggest that there would be no real difference in the kinds of fauna present. The nearby Caminada-Barataria Bay system has been well studied

in recent years by personnel of the L.S.U. Marine Sciences Department, the Louisiana Wild Life and Fisheries Commission, and other groups. The various faunal assemblages, including fishes, macroscopic invertebrates, zooplankton, and endangered species occurring in the project area are discussed below.

Species of fishes which have been collected near the project area are listed in Table A-14. The list is not all-inclusive, but it does consist of the more common species which may be expected to occur in the Port Fourchon project area. Important sport fishes included in the list are such species as spotted sea-trout, red drum, and southern flounder. The lower one-third (approximately) of the project area, including Pass Fourchon, Chevron Canal, and the various canals and bayous in this area, would appear to provide excellent sport fishing. Sport fishermen were observed fishing in this area on several occasions. Numerous redfish were observed in the shallow bayou connecting with the Tennessee Gas Transmission Canal on one field trip to the project area.

Other fishes on the list are important commercial fish resources. Included in this category are menhaden and croakers. Menhaden landings in Louisiana exceed those of all other fisheries in poundage. The Atlantic croaker is the principal component of the industrial bottomfish fishery which also utilizes a wide variety of other species.

Other species on the list play imporant ecological roles in estuarine waters. The abundant bay anchovy is an important food item of juvenile sport fishes. Other small fishes, such as the various killifishes, gobies, mullet, silversides, and small flatfishes are also important food web organisms.

b) Macroscopic Invertebrates

This category includes a diverse assemblage of invertebrate animals which are large enough to be seen with the unaided eye. The economically outstanding organisms in this group include commercial shrimp, crabs, and oysters. Other species of ecological importance are listed below.

Ctenophores (Comb-jellies) - Although ctenophores lead a planktonic existence, they are large enough to be seen without magnification. Ctenophores are often very abundant in estuarine waters. The most common species encountered in the project area is probably Beroe ovata, although Guillespie (1971) listed Mnemiopsis mccradyi as also being common. Ctenophores may be recognized by the beautiful irridescent sheen reflected from the comb plates as they swim slowly through the water. The exact position of comb-jellies in the food web is unclear; they feed on zooplankton but do not themselves appear to be utilized as food by other organisms.

Annelids - Polychaete worms are an important segment of the estuarine fauna. Near the project area the polychaete Neanthes succinea appears to be most abundant in the marsh sediments where they burrow through the mud feeding on diatoms, detritus, and small crustaceans

Table A-14 List of species of fish common in the study area.

Common Name	Scientific Name
Largescale menhaden	Brevoortia patronus
Bay anchovy	Anchoa mitchilli
Gafftopsail catfish	Bagre marinus
Sea catfish	Galeichthys felis
Atlantic needlefish	Strongylura marina
Sheepshead minnow	Cyprinodon variegatus
Gulf killifish	Fundulus grandis
Longnose killifish	Fundulus similis
Sailfin nolby	Poecilia latipinna
Gulf pipefish	Synagnathus scovelli
Bluefish	Pomatomus saltatrix
Crevalle jack	Caranx hippos
Bumper	Chloroscombrus chrysurus
Pompano	Trachinotus carolinus
Silver perch	Bairdiella chrysura
Sand seatrout	Cynoscion arenarius
Spotted seatrout	Cynoscion rebulosus
Spot	Leiostomus xanthurus
Southern kingfish	Menticirrhus americanus
Atlantic croaker	Micropogon undulatus
Black drum	Pogonias cromis
Red drum	Sciaenops ocellata
Sheepshead	Archosargus probatocephalus
Pinfish	Lagodon rhomboides
Atlantic spadefish	Chaetodipterus faber
Atlantic cutlassfish	Trichiums lepturus
Spanish mackerel	Scomberomorus naculatus
Fat sleeper	Dormitator maculatus
Sharptail goby	Gobionellus hastatus
Naked goby	Gobiosoma bosci
Clown goby	Microgolius gulosus
Bighead searobin	Prionotus tribulus
Freckled blenny	Hypsoblennius ionthas
Striped mullet	Mugil cephalus
Rough silverside	Membras nartinica
Tidewater silverside	Menidia beryllina
Atlantic threadfin	Polydactylus octonemus
Bay whiff	Citharichthys spilopterus
Fringed flounder	Etropus crossotus
Southern flounder	Paralichthys lethostigma
Lined sole	Achirus lineatus
Hogchoker	Trinectes naculatus
Blackcheek tonguefish	Symphurus plaguisa
Southern puffer	Sphaeroides nephelus
Gulf toadfish	Opsanus beta
Atlantic midshipman	Porichthys porosissimus

Source: Compiled from several sources and personal communication.

(Day et al., 1973). Polychaetes are consumed by many bottom-feeding fishes and probably also by various crabs. Tube-dwelling, filter-feeding polychaetes were observed in the project area in a sandy bottomed area near the mouth of Bayou Lafourche. Oysters are often infested with a small polychaete (Polydora sp.) which lives inside the shell.

c) Mollusca and Crustacea

Mollusks occurring in estuarine habitats include gastropods (snails), and pelecypods (bivalves). One cephalopod - the squid (Lolliguncula brevis) - is also common in the Barataria estuary.

Common gastropods occurring in the project area are the marsh dwelling species Littorina irrorata, Melampus sp., and Neritina reclivata. These snails are often seen clinging to the Spartina, where they graze on epiphytic algae, diatoms, and detritus. The oyster drill (Thais haemastoma) is a common marine gastropod which is a major predator on bivalves, including oysters.

Bivalve mollusks of importance in the project area include the ribbed mussel (Modiolus demissus) and the American oyster (Crassostrea virginica). Clumps or groups of ribbed mussels live partially buried in the sediments on the marsh floor. The ribbed mussel is a filter feeder which feeds on detritus, algae, and other suspended matter brought near its siphons when tides flood the marshes.

The American oyster is the most important mollusk present in the project area from an economic standpoint. Oyster fishermen in Lafourche Parish produced 2,363,000 lbs of raw oyster meat in 1971 with a value to the fishermen of $1,031,000. Signs marking an oyster lease were observed in the project area near the Tennessee Gas Transmission Canal indicating that the project area is or has been utilized by oyster fishermen. Oyster fishing as currently practiced in Louisiana is actually a sea farming operation. Young ("seed") oysters are dredged from seed ground reservations and are transported to low salinity (1-15%) areas where they are allowed to grow for about 15 months. Lower salinities decrease the quantities of oysters lost to predators such as the oyster drill. After this time the oysters are again moved to higher salinity waters (10-25%) where they are allowed to "fatten" or "grow salty" for about six months, after which time they are harvested.

Besides their obvious economic importance, oysters are also ecologically important. Under natural conditions oysters will form reefs which may be extensive. These reefs of living oysters and oyster shells form a hard substrate for the attachment of other marine organisms such as algae, anemones, bryozoans, and various tube-dwelling worms. The nooks and crevices of oyster reefs are often occupied by small crabs, shrimp, and fishes. Young oysters and the associated reef fauna form a food source for certain fishes (black drum, sheepshead), stone crabs, and other animals. The oyster reef is a community of living organisms.

In general, the major commercial shrimps of the Barataria estuary and the northern Gulf are the brown shrimp (Peneaus aztecus) and the white shrimp (Peneaus setiferus). Also caught in much smaller quantities are the pink shrimp (Penaeus duorarum), the seabob (Xiphopenaeus kroyeri), and the rock shrimp (Sicyonia brevirostris). Shrimp are the most valuable fishery product of the Gulf of Mexico. The landings of shrimp in Lafourche Parish in 1971 were 15,832,000 lbs, valued at $8,159,000.

Brown and white shrimp are estuarine dependent organisms. Shrimp spawn offshore and the postlarval shrimp migrate or are otherwise carried into the estuaries where they feed and grow, then return to the Gulf as near mature shrimp. Besides their enormous economic value, shrimp are an integral part of the estuarine food web and are utilized as food by many predatory fishes.

Smaller non-commercial crustaceans, such as the abundant grass shrimp (Palaemonetes sp.), the mantis shrimp (Squilla empusa - a stomatopod), and the amphipods (Corophium and Ampelesca) are utilized as food organisms by species which are of more direct value to man.

The blue crab (Callinectes sapidus) is another commercially important species which is the object of an extensive fishery. Blue crabs are estuarine-dependent crustaceans which mate in estuaries and spawn in near-offshore areas. Crab larvae drift back into the estuary where they grow to maturity. Male crabs often penetrate well into freshwater areas before returning to the estuary to mate. Blue crabs are omnivores, feeding on both plant and animal material and on organic detritus. They are abundant in the Barataria estuary and in the project area.

Other crabs of ecological importance include the stone crab (Menippe mercenaria), which is a predator on oysters, the fiddler crab (Uca pugnax), and the square-backed crab (Sesarma reticulatum). The latter two crabs inhabit the marshes where their burrowing activities rework the marsh sediments. Hermit crabs (Clibanarius sp.) are common benthic scavengers.

Guillespie (1971) studied the zooplankton populations of the Louisiana coast. Several of her sample stations were located near the project area in the Barataria-Caminada estuary. It may be assumed that the zooplankton populations occurring in the project area are similar.

Crustaceans were most abundant in the samples. The copepod (Acartia tonsa) was found by Guillespie to be the predominant zooplankton in the Barataria estuary as well as along the entire Louisiana coast. Copepods were in general the most abundant members of the zooplankton, based largly on the abundance of A. tonsa alone. Other common copepods included Centropages sp., Eurytemora hirundoides, Labidocera aestiva, Temora sp., and Tortanus sp.

Besides copepods, other crustaceans which accounted for a considerable portion of the plankton included barnacle nauplii, ostracods, cladocerans, and decapod larvae. These last included the zoea and magalops larvae of brachyuran crabs, mostly the blue crab (Callinectes sapidus). Adults and larvae of the small decapods Leander tenuicornis and Lucifer faxoni were also common in the samples.

Fish eggs and larvae were taken in plankton samples throughout the year. Most fish larvae collected were those of menhaden (Brevoortia patronus), bay anchovy (Anchoa mitchilli), and silversides (Menidia beryllina). Planktonic tunicates, Oikopleura sp., occurred commonly in the samples from the Barataria region. The chaetognath Sagitta hispida was often an abundant member of the zooplankton community particularly along the central Louisiana coast.

Besides the above-mentioned species, the bioluminescent dinoflagellate Noctiluca scintillans is often present in the Barataria region. Ctenophores, already discussed as macroscopic invertebrates, often filled Gillespie's samples. Beroe ovata was the most common ctenophore encountered.

3. Wildlife Habitat and the Project

The project will alter about 500 acres of land which has been partially altered already. (Fig. A-1, A-2). Areas presently in spoil bank, water, or marsh will be converted to filled land or dredged channel. There will be some alteration of vegetation but stream flow will not be affected. Most of the site area under the jurisdiction of the Port Commission will remain as wildlife habitat.

Spoil and fresh marsh are the primary habitat zones affected by the project. There will be a loss of nesting areas for small mammals and some loss of food supply and cover. There are other similar habitats in the immediate vicinity of the project therefore the purchase of a replacement habitat is not considered necessary.

Although the site is in the general range of several endangered species, the development of this site is not considered to jeopardize their continued existence since it does not result in the destruction or modification of habitat used by these species for reproduction. In coordination of analysis with the U.S. Fish and Wildlife Service, rare and endangered species were not mentioned as a major constraint to the project.

J. FARMLANDS

There are no farm lands in the study area.

K. RECREATIONAL ELEMENTS

1. General Description

The coastal region of Louisiana dominates the tourist and recreation activity in the state. Water oriented recreation activities are concentrated along the southern tip of Lafourche Parish. The coastal marshes and associated estuarine areas provide the opportunity for water sports. Participation in twenty-four recreational activities enjoyed in six southern Louisiana parishes (of which Lafourche parish is included) is shown in Table A-15. About 40% of the activities listed are enjoyed outdoors and the majority of them are related to the coastal wetlands. User-days for these activities are projected to increase by about 25% by 1985. Recreation provided in past years and projected until 1979 is shown in Table A-13.

Lafourche Parish offshore waters are among the most productive in the Gulf Coast for sports angling, due in part to the numerous offshore oil and gas platforms. These platforms serve as artificial reefs, attracting and concentrating many species of saltwater fish. Several fishing rodeos are held in the area from May to October. Every August the three-day Tarpon Rodeo on neighboring Grand Isle attracts thousands of visitors.

The only State Park near the Port Fourchon site is located on the east end of Grand Isle, approximately 20 mi away. Grand Isle State Park, 140 acres, offers access to the Gulf of Mexico and a beach. Jetties there can be used for fishing.

A 3 mi beach streteches from Bayou Lafourche to Bay Champagne and offers opportunities for recreation. A small boat launch site has been built with funds provided through a grant from the U.S. Bureau of Recreation and is used by sportsmen in the area (see Fig. A-1).

Hunting is another popular sport in the area since Lafourche Parish has one of the finest hunting grounds in the state. The marshes are wintering grounds for migrating wild geese and ducks. The hunting season for both resident and migratory game opens in early September and continues for about five months through the winter.

The Wisner Wildlife Management area is adjacent to the Port Fourchon area. The 26,000 acres of the Wisner Wildlife Management area are owned by the Wisner Donation Foundation and consist of low saline marshes with dense stands of oyster grass. Hunted species at Wisner are mainly waterfowl, rail, gallinule, snipe, and rabbits. Main fish species are speckled trout, flounder, redfish, black drum, sheepshead, and croaker. Crabbing and shrimping are also favorite sports for the people in the area.

Table A-15. Participation by activity of persons six years and older, Region 3.

ACTIVITY		1970 User Days	1975 User Days	1980 User Days	1985 User Days
Swimming - Pool	Summer[1/]	978,485	1,071,875	1,176,565	1,292,645
	Summer Sunday	28,180	30,870	33,885	37,228
Beach	Summer	553,823	606,681	665,936	731,637
	Summer Sunday	15,950	17,472	19,178	21,071
Bicycling	Summer	1,207,450	1,322,694	1,451,881	1,595,123
	Summer Sunday	34,775	38,094	41,814	45,939
Driving for Pleasure	Summer	812,143	889,656	976,548	1,072,895
	Summer Sunday	23,390	25,622	28,124	30,899
Playing Outdoor Games	Summer	763,218	836,063	917,721	1,008,263
	Summer Sunday	21,981	24,079	26,430	29,066
Fishing	Summer	612,532	670,994	736,530	809,195
	Summer Sunday	17,641	19,325	21,212	23,304
Walking for Pleasure	Summer	545,995	598,106	656,523	569,823
	Summer Sunday	15,725	17,225	18,907	16,410
Sightseeing	Summer	473,587	518,788	569,457	625,640
	Summer Sunday	13,639	14,941	16,400	18,018
Attending Outdoor Sports Events	Summer	410,964	450,188	494,157	542,910
	Summer Sunday	11,836	12,965	14,231	15,635
Picnicking	Summer	350,298	383,731	421,210	462,766
	Summer Sunday	10,089	11,051	12,130	13,327
Motor Boating	Summer	336,599	368,725	404,738	444,669
	Summer Sunday	9,694	10,619	11,656	12,806
Hunting	Fall/Winter	324,857	355,863	390,620	429,158
	Fall/Winter Sunday	9,356	10,249	11,249	12,359

(Continued)

Table A-15. (Continued)

ACTIVITY		1970 User Days	1975 User Days	1980 User Days	1985 User Days
Camping - Trailer	Summer	152,644	169,553	183,544	201,650
	Summer Sunday	4,396	4,833	5,286	5,807
Camping - Tent	Summer	109,590	121,730	131,775	144,776
	Summer Sunday	3,156	3,506	3,795	4,169
Crabbing	Summer	160,472	178,248	192,957	211,993
	Summer Sunday	4,622	4,883	5,557	6,105
Horseback Riding	Summer	140,902	156,510	169,425	186,140
	Summer Sunday	4,058	4,507	4,879	5,360
Bird Watching	Summer	131,117	145,641	157,660	173,214
	Summer Sunday	3,776	4,194	4,540	4,988
Water Skiing	Summer	117,418	130,425	141,188	155,117
	Summer Sunday	3,382	3,756	4,066	4,467
Crawfishing	Summer	95,891	106,514	115,303	126,679
	Summer Sunday	2,762	3,068	3,320	3,648
Playing Golf	Summer	88,064	97,819	105,891	116,338
	Summer Sunday	2,536	5,349	5,645	3,350
Nature Walks	Summer	80,236	89,124	96,478	105,996
	Summer Sunday	2,311	2,567	2,778	3,052
Hiking	Summer	64,580	71,734	77,653	85,314
	Summer Sunday	1,860	2,066	2,236	2,457
Attending Outdoor Concerts, Plays	Summer	29,355	32,606	35,297	38,779
	Summer Sunday	845	939	1,016	1,116
Canoeing	Summer	27,398	30,433	32,944	36,194
	Summer Sunday	789	876	945	1,042
Sailing	Summer	13,699	15,216	16,472	18,097
	Summer Sunday	395	438	474	521

Source: Louisiana State Parks and Recreation Commission, 1974b.

SECTION B: NOISE IMPACTS

The proposed port is not a noise sensitive facility, but the project itself will generate noise through increased industrial/commercial activities. The primary consideration with regard to noise in the general project area is recreation along the beach to the south. No sensitive recepters exist presently in the area and the nearest residential development is more than 5 mi to the east. The project is not in an unacceptable noise zone as defined by HUD Circular 1390.2 (U.S. Department of Interior, 1975).

The undeveloped recreational beach area lies 1 mi to the southeast. No sound barriers are present between the beach and the project area. At present the area is only affected by boat traffic through Belle Pass. Noise criteria established by the U.S. Department of Interior, 1975, for recreational areas are 45 dBA during the daytime, 40 dBA in the evening and 30 dBA at night. Application of these criteria to the southern project area boundary as a line source allows sound at the project boundary to reach a magnitude of up to 90 dBA at night and up to 105 dBA during the daytime. It is not likely that such levels will be attained and noise pollution therefore is not considered to adversely affect recreational activities along the beach area. Noise levels will be further reduced as a result of sea breezes during most of the recreation season.

The general effect of noise on terrestrial wildlife (including birds) is likely to be one of the wildlife's avoidance of the immediate project area.

Noise from boat traffic or project construction and maintenance is not considered to add significantly to the ambient noise level in the area since Bayou Lafourche is already a major waterway for commercial fisheries and offshore oil industry service.

SECTION C: AIR QUALITY

The project area and site have a high air quality. Neither the area nor the site have a history of air pollution, and air quality meets the National Ambient Air Quality Standards and the State Standards.

The coastal setting of the project area provides for nearly continuous air movement so that potential pollutants are dispersed rapidly. The conditions are furthermore enhanced by low atmospheric stability and limited atmospheric inversion frequency. No topographic or vegetative barriers exist to adversely affect ventilation. Wind speeds are greater than 5 mi per hour during 85 percent or more of the time (Tables C-1 through C-4).

Atmospheric stability has been measured at Taft, in coastal Louisiana, by the Louisiana Power and Light Company (1974). These measurements, taken from May 1972 through April 1973, showed that moderate to extremely stable conditions occurred only during 26 percent of the year. Neutral to slightly stable conditions occurred during 60 percent of the year. It should be pointed out, however, that these measurements most likely overestimate atmospheric stability for the project area because they were obtained some 50 mi inland from the coast line.

Atmospheric inversion in the project area has an average annual frequency of approximately 25 percent of total hrs (Hosler, 1961). Inversion frequency ranges from 35 percent in the winter to 20 percent in the summer.

At present no industrial concentrations or major population centers exist in the area; therefore major sources of air contaminants are absent. The project area is more than 5 mi from human habitation and no sensitive facilities are in the area.

Project construction and maintenance and anticipated development are not expected to measurably change air quality or to have major short-term or adverse long-term effects, including those on the micro-climate of the area. During construction and maintenance, emissions from the dredge and earthmoving equipment and dust particles will be released into the air. These will temporarily degrade local air quality but these sources are not considered to add significantly to ambient air pollution.

During operation of the projected port facility boat traffic is anticipated to increase but not to the extent that present levels of typical emissions related to diesel engines of fishing boats and work boats are significantly exceeded. The same applies to emissions of automobiles.

Anticipated types of industrial development include fish processing and oil-rig fabrication yards. Neither of these is known to contribute significantly to degradation of ambient air quality levels.

Table C-1. Average percentage frequency of occurrence of wind speed - Direction groups: Grand Isle, Block 46: Offshore Louisiana: July.

Direction	Wind Speed Groups (Miles Per Hour) 0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-40	40 Plus	Total
N	0.3	0.8	0.7	0.2	0.0	0.0	0.0	0.0	0.0	2.0
NE	0.5	1.0	1.0	0.4	0.1	0.0	0.0	0.0	0.0	3.0
E	1.1	2.3	2.4	0.9	0.3	0.1	0.1	0.0	0.0	7.2
SE	2.6	6.0	6.3	2.2	0.4	0.3	0.2	0.1	0.0	18.1
S	3.2	7.5	7.8	2.8	0.5	0.3	0.2	0.1	0.0	22.4
SW	4.3	9.9	8.2	3.2	0.5	0.1	0.0	0.0	0.0	26.2
W	2.3	5.8	5.0	1.9	0.3	0.1	0.0	0.0	0.0	15.4
NW	0.8	2.0	1.9	0.7	0.2	0.1	0.0	0.0	0.0	5.7
Total	15.1	35.3	33.3	12.3	2.3	1.0	0.5	0.2	0.0	100.0

Source: Stone, James, et al., 1973 (Data extracted from Glen, 1972).

Table C-2. Average percentage frequency of occurrence of wind speed - Direction groups: Grand Isle, Block 46: Offshore Louisiana: September.

Direction	Wind Speed Groups (Miles Per Hour) 0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-40	40 Plus	Total
N	0.4	1.3	1.7	1.3	0.8	0.3	0.2	0.1	0.2	6.3
NE	1.5	3.8	5.7	4.8	2.5	0.9	0.8	0.3	0.7	21.0
E	1.6	4.6	7.6	6.3	3.3	1.3	1.0	0.4	0.7	26.8
SE	1.6	4.1	6.5	5.4	2.8	1.1	0.8	0.4	0.8	23.5
S	0.8	2.1	2.9	2.3	1.3	0.5	0.3	0.1	0.3	10.6
SW	0.6	1.2	1.0	0.7	0.5	0.2	0.1	0.1	0.1	4.5
W	0.5	1.4	1.2	0.6	0.3	0.1	0.0	0.0	0.0	4.1
NW	0.3	0.7	0.9	0.8	0.4	0.1	0.0	0.0	0.0	3.2
Total	7.3	19.2	27.5	22.2	11.9	4.5	3.2	1.4	2.8	100.0

Source: Stone, James, et al., 1973 (Data extracted from Glen, 1972).

Table C-3. Average percentage frequency of occurrence of wind speed - Direction groups: Grand Isle, Block 46: Offshore Louisiana: October.

Direction	Wind Speed Groups (Miles Per Hour) 0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-40	40 Plus	Total
N	0.4	1.3	2.6	2.8	2.0	1.3	0.8	0.3	0.5	12.0
NE	1.1	4.5	7.9	7.5	4.6	1.8	1.2	0.3	0.6	29.5
E	0.8	3.5	6.6	6.0	3.8	1.5	1.1	0.3	0.6	24.2
SE	0.8	2.3	4.4	4.1	2.4	1.0	0.6	0.2	0.4	16.2
S	0.5	1.7	2.6	1.8	0.8	0.3	0.1	0.0	0.0	7.8
SW	0.5	0.8	0.6	0.4	0.2	0.1	0.0	0.0	0.0	2.6
W	0.5	0.8	0.6	0.4	0.2	0.1	0.0	0.0	0.0	2.6
NW	0.3	0.8	1.3	1.4	0.7	0.3	0.2	0.1	0.0	5.1
Total	4.9	15.7	26.6	24.4	14.7	6.4	4.0	1.2	2.1	100.0

Source: Stone, James, et al., 1973 (Data extracted from Glen, 1972).

Table C-4. Average percentage frequency of occurrence of wind speed - Direction groups: Grand Isle, Bloc: 46: Offshore Louisiana: December.

Direction	Wind Speed Groups (Miles Per Hour) 0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-40	40 Plus	Total
N	0.3	1.0	2.3	3.1	2.7	2.3	1.8	1.2	1.9	16.6
NE	0.4	2.1	4.6	6.7	5.1	2.1	1.6	0.8	1.3	24.7
E	0.4	1.6	3.5	4.7	2.8	1.0	0.7	0.3	0.5	15.5
SE	0.4	1.7	3.4	4.6	2.8	1.0	0.7	0.2	0.4	15.2
S	0.4	1.1	2.6	3.1	2.2	0.7	0.3	0.1	0.2	10.7
SW	0.3	1.2	1.6	1.3	0.8	0.1	0.0	0.0	0.0	5.3
W	0.3	0.5	0.7	0.7	0.5	0.3	0.2	0.1	0.1	3.4
NW	0.3	0.6	1.3	1.8	1.4	1.2	0.8	0.5	0.7	8.6
Total	2.8	9.8	20.0	26.0	18.3	8.7	6.1	3.2	5.1	100.0

Source: Stone, James, et al., 1973 (Data extracted from Glen, 1972).

Objectionable odors can be expected from the depostion of dredge material on land due to decomposition of vegetation and organic materials contained in the dredge spoil. This would be a temporary effect which could be expected to disappear in 2 to 3 months. A potential for objectionable odors also lies in the anticipated fish processing industry; however, this is considered a manageable source through control over waste disposal.

SECTION D: WATER QUALITY

A. STATE WATER QUALITY STANDARDS

General and specific water quality criteria have been set for Bayou Lafourche by the State of Louisiana. For Lower Bayou Lafourche, water should allow primary and secondary contact recreation and should encourage the propagation of fish and wildlife. Dissolved oxygen should not become less than 4.0 miligrams per liter (mg/l), pH should be within the range of 6.5 to 9.0, and the monthly total coliform median (MPN) should not exceed 70 per 100 and not more than 10 percent of the samples may exceed an MPN of 230/100 mililiters (ml). No standards have been set for chlorides, sulphates, and total dissolved solids (Louisiana Stream Control Commission, 1973). Because of salinity, Lower Bayou Lafourche does not serve as a domestic or industrial water supply.

B. PRESENT CONDITIONS

The water quality of Bayou Lafourche relative to the project area is first dependent on that of the Mississippi River and runoff from towns, agriculture, and industries along the bayou, since the base supply is obtained from shore sources. Changes in quality occur all along the course of Bayou Lafourche as a result of development on its natural levee ridges, exchange with water from adjacent estuaries, navigation, and exchange with Gulf of Mexico waters. As a result of the changing intensity of the processes that affect water characteristics in Bayou Lafourche, a wide variation of physical and chemical properties is encountered in location and over time.

Water quality measurements are made by the U.S. Army Corps of Engineers, New Orleans District, at two stations along Lower Bayou Lafourche. These are located 5 mi below Leeville and at the mouth of Bayou Lafourche. The project area is located approximately halfway between those two stations. Water quality data for Lower Bayou Lafourche are shown in Tables D-1 and D-2.

Temperature in 1975 showed a natural fluctuation between a low of 13.4°C and a high of 32.2°C. No difference is apparent between the two stations referred to, therefore temperatures shown may be considered to be representative for the study area.

Conductivity expressed in 1000 micro-ohms/cm is approximately 20 percent higher at the mouth of Bayou Lafourche than at the station near Leeville. This can be attributed primarily to higher salinities as a result of proximity to the Gulf of Mexico. Conductivity measurements vary greatly in Lower Bayou Lafourche. A study by Whitehurst (1974) showed average conductivity variations of 10,000 micro-ohms at Golden Meadow, 21 mi above the mouth of Bayou Lafourche.

Near the project area, continuous salinities are available for the USCE gaging station at Leeville proper. Data from this station for the period of 1962 through 1968 showed a mean salinity at mid-depth of 17.4 parts per tho (ppt) with a variance of 10.5 ppt. Salinities of Gulf waters at the mouth of Bayou Lafourche are probably similar to those measured at the Grand Isle mine platform and are mainly affected by Mississippi River discharges. Salinities at mid-depth at the platform over the period 1962 through 1968 averaged 26.1 ppt with a variance of 9.8 ppt. USCE data (USCE, 1972a) gives a salinity range of 23.4 to 28.8 ppt at the mouth of Bayou Lafourche.

Dissolved oxygen is invariably higher at the mouth of Bayou Lafourche than near Leeville as a result of greater turbulence and dilution of Bayou Lafourche water with seawater. Average dissolved oxygen concentration at the mouth of Bayou Lafourche was 7.5 mg/l versus 6.8 mg/l near Leeville. Even at the mouth of Bayou Lafourche, however, oxygen content showed considerable variation, ranging between a low of 3.9 mg/l in September, 1975 to a high of 10.5 mg/l in July, 1975. The above readings show much improvement in water quality over conditions further upstream. Above Mile 33, oxygen contents are barely above the legal standard of 4 mg/l.

Table D-1. Hydrologic and water quality data, lower Bayou Lafourche at Gulf of Mexico.

DATE	TIME	DEPTH OF OBSER-VATION	00010 WATER °C	00094 CNDUCTVY FLD,1000 UMHO/CM	00299 DO PROBE MG/L	00400 pH SU	00900 TOTAL HARDNESS CACO3 MG/L	00940 CHLORIDE Cl MG/L
75/01/07	1600	2.00	15.6	21.20	7.2	6.7	--	--
75/01/16	1320	2.00	14.2	25.40	7.0	6.1	--	--
75/01/31	1307	2.00	17.6	14.40	8.4	6.6	--	--
75/02/27	1232	2.00	18.4	1.40	7.5	8.2	--	--
75/03/12	1705	2.00	22.2	28.90	7.7	--	--	--
75/03/26	1437	2.00	--	28.70	8.8	8.7	--	--
75/04/08	1145	2.00	20.4	34.40	8.3	8.5	--	--
75/04/23	2028	2.00	21.8	18.20	9.7	8.1	--	--
75/05/06	1445	2.00	25.8	30.30	8.2	7.9	--	--
75/05/21	0905	2.00	27.4	25.80	7.7	8.2	--	--
75/06/03	1018	2.00	29.0	--	--	8.1	--	--
75/06/17	1412	2.00	28.5	24.40	8.9	7.8	--	--
75/07/01	1700	2.00	28.2	21.98	6.4	9.2	--	--
75/07/15	1901	2.00	29.2	42.50	10.4	8.3	--	--
75/07/29	1032	2.00	30.0	53.60	6.3	8.2	--	--
75/08/13	0905	2.00	29.9	29.20	7.2	7.9	--	--
75/08/26	1831	2.00	32.2	36.10	8.5	7.9	--	--
75/09/03	1550	2.00	--	--	--	--	4450	13000
75/09/08	0925	2.00	29.7	32.30	3.9	8.7	--	--
75/09/16	1218	2.00	28.1	28.80	4.8	9.3	--	--
75/10/08	1516	2.00	23.9	37.20	6.0	8.7	--	--
75/10/20	1358	2.00	23.3	37.80	8.1	8.9	--	--

Source: U.S. Army Corps of Engineers, 1975b.

Table D-2. Hydrologic and water quality data, lower Bayou Lafourche 5.0 miles, south of Leeville, Louisiana.

DATE	TIME	DEPTH OF OBSERVATION	00010 WATER °C	00094 CNDUCTVY FLD,1000 UMHO/CM	00299 DO PROBE MG/L	00400 pH SU
75/01/07	1605	2.00	15.8	21.40	6.3	6.7
75/01/16	1330	2.00	13.4	20.40	7.0	6.3
75/01/31	1254	2.00	19.4	21.00	7.2	6.5
75/02/27	1213	2.00	16.2	26.00	8.0	6.1
75/03/12	1640	2.00	24.5	29.10	7.1	--
75/03/26	1500	2.00	--	39.20	8.2	8.6
75/04/08	1211	2.00	21.1	35.20	7.8	8.4
75/04/22	1619	2.00	21.0	17.60	8.1	7.6
75/05/05	1839	2.00	26.4	30.20	7.6	7.1
75/06/03	0954	2.00	27.3	--	--	7.0
75/06/17	1425	2.00	28.9	24.34	9.6	7.7
75/07/01	1648	2.00	29.1	14.54	6.3	8.1
75/07/15	1854	2.00	29.9	26.60	8.3	7.8
75/07/29	1044	2.00	29.5	24.40	5.7	7.6
75/08/17	1440	2.00	32.0	20.30	5.7	6.9
75/08/26	1150	2.00	32.3	25.20	5.7	7.9
75/09/08	0920	2.00	29.4	21.50	4.0	8.0
75/09/16	1213	2.00	28.5	28.60	4.9	8.9
75/10/03	1513	2.00	23.7	29.60	5.8	8.7
75/10/20	1354	2.00	22.1	31.20	6.9	8.7

Source: U.S. Army Corps of Engineers, 1975b.

Measurements of pH at the mouth of Bayou Lafourche and near Leeville show 1975 averages of 8.1 and 7.6. In both cases, variation is wide, ranging between 4.0 and 9.6 near Leeville and between 6.1 and 9.2 at the mouth of Bayou Lafourche.

Turbidity in Lower Bayou Lafourche is generally high as a result of the shallowness and the great volume of traffic. Turbidation decreases, however, nearer the mouth because dredging has provided a deeper channel and mixing with less turbid Gulf waters occurs. Normal turbidity levels in the vicinity of Golden Meadow are on the order of 25 JTU.

Nitrate and phosphate concentrations for Bayou Lafourche could only be obtained as far south as Leeville. This is 5 mi north of the study area where the Bayou connects with the estuarine system through the southwestern canal. Average nitrate concentrations at this point were 0.87 mg/l. Average nitrate concentrations for Lower Bayou Lafourche is on the order of 1.0 mg/l (Whitehurst, 1974). Total phosphate values along Bayou Lafourche fall rapidly south of Golden Meadow. Near Leeville total phosphate concentrations were 4.52 mg/l. These values most probably overestimate concentrations at the project area because of increased mixing with Gulf of Mexico and estuarine waters.

C. ENVIRONMENTAL EFFECTS

1. Water Temperature

No changes in water temperature are anticipated. Although some saltwater intrusion is expected as a result of channel enlargement, water exchange processes between the project area and Gulf of Mexico waters are such that this will not measurably affect the ambient temperature conditions. Anticipated industrial development in the project area does not include industries requiring thermal discharge.

2. Water Solids Content

Water solids content is expected to increase temporarily as a result of increased suspension of sediments due to dredging, dredge effluent, dike effluent, and surface runoff. A temporary increase in turbidity will result. Since much of the material will be sand and silt with associated high settling rates, increases in turbidity will be of short duration. Since flow in the Pass Fourchon and the flotation canal is limited to tidal exchange, the areal extent of the turbidity increases is anticipated to be limited mainly to those two water bodies. The use of gates in the diked area will limit turbidity increase from dike effluent.

Associated with the resuspension of sediments due to dredging and spoil disposal, a temporary local increase in dissolved solids must be anticipated. This increase, however, is not expected to adversely affect water quality and biota. The majority of the spoil is produced through dredging of the 20 x 400 ft slip and involves deposits laid down more than a thousand years ago. These sediments are unlikely to contain any toxic substances. Redredging of Pass Fourchon and the flotation canal is a repeat action that is not known to have produced unacceptable concentrations of dissolved solids since the project area is not subject to industrial or other discharges containing heavy metals or other toxic substances. A dredging permit has been granted by the U.S. Army Corps of Engineers under Section 404 of the Federal Water Pollution Control Act (U.S. Congress, 86 Stat. 816, 1972).

Anticipated future maintenance dredging also is considered not to have long-term or severe short-term affects on water quality if adequate measures are taken with regard to potential future industrial discharge at the facility.

Permanent changes in solids content of the water may occur as a result of further development of the area as a port facility serving commercial fisheries and offshore oil industry. Road construction and increased traffic will add road-associated pollutants to the water through local runoff. Increased concentration of boats will add

pollutants of various sorts including oil and grease, ship garbage, and trash fish. Oil and grease pollution can result from minor accidental spills or bilge pumping.

Anticipated industrial development includes fish processing, boat repair, and drilling rig fabrication yards. Two potentially serious problems are associated with this. The first is the disposal of shellfish wastes, consisting largely of shrimp heads and shells. The second is the potential introduction of toxic metals or acids associated with materials used in fabrication of vessels and rigs. Whether this will be an actual problem will depend on waste disposal and processing programs and the degree of enforcement. Surface drainage design and treatment of storm drainage and industrial waste water are considered feasible measures to maintain acceptable water quality levels.

3. Nitrogen Saturation

No significant change in nitrogen saturation is expected if adequate measures are taken for disposal of wastes and waste water from anticipated seafood processing industries. Sewage will be subjected to tertiary treatment.

4. Hazardous Chemicals

On the basis of expected types of industrial development, discharge of hazardous chemicals is not anticipated.

5. Pathogens

No significant change in pathogens is expected because of tertiary treatment of sewage and limited increase of population in the project area.

6. Eutrophication

The nature of the project is not such that water impoundment or temperature changes will be caused, and therefore will not change the rate of eutrophication as a result of those possible causes.

7. Taste and Odor

Provided that satisfactory methods are applied in potential disposal of fish processing wastes, no taste or odor changes of the water are expected.

D. WATER QUALITY CHANGES

Changes in water quality due directly to project construction and maintenance are not considered to create conditions which are outside of permissable or desirable conditions as expressed by water quality standards or general social opinion. Changes will not significantly modify present conditions associated with existing levels of boat traffic and existing docking facilities for commercial fisheries.

Changes in water quality due to future development will depend on the nature of future industries. Whether the project will attract fish processing industry and oil rig fabrication yards cannot be accurately predicted. There will undoubtedly be some degradation of water quality derived from boat traffic, minor spills, bilge pumping, and industries. Yet the nature and extent of degradation is dependent on a large number of elements that are unknown at the pre-project period. Major among these are processing of industrial waste, discharge of surface water drainage, monitoring and enforcement, and adherance to discharge permits and criteria. Provided that the best available technology is used in waste processing, that surface water drainage is not directly discharged into adjacent waters, and that waste discharge standards are adhered to, potential water quality changes are not considered to create conditions that have an unacceptable adverse impact.

Relative to the above consideration, the construction of a tertiary treatment facility subsequent to rather than commensurate with preparation for development under Phase 4 may be contrary to desirable control over discharge of waste water.

SECTION E: WASTE WATER TREATMENT PLANTS

The project is not a waste water treatment plant. It contains a waste water treatment plant as part of Phase 5 development. At such time as it may be constructed, appropriate procedures will be followed in its planning, design, permitting, construction, and operation.

SECTION F: SOLID WASTE MANAGEMENT

Under the remaining phases of the project a limited amount of solid waste will be generated related to construction of necessary buildings for administration and utilities. This will be primarily construction waste, proper disposal of which will be the responsibility of the construction contractor. These materials are expected to be removed from the site by the contractor and disposed of according to state regulation at designated sites, or will be disposed of in containers presently available at the project site. Containerized waste is presently collected twice each week by Sugarland Disposal, Inc., of Houma, Louisiana, and waste is disposed of at a designated land-fill in Galliano, Louisiana.

The container system also serves present docking facilities at the commercial marina in the northern part of the project area. The system is expected to be expanded to accommodate ship garbage associated with future docking and terminal facilities along the proposed slips and solid waste associated with occupancy of the planned administration and utility building.

A potential indirect effect of the project is the generation of waste related to the establishment of fish processing, rig fabrication, and boat repair facilities. Because it will be the responsibility of individual industries to dispose of solid wastes generated by such industry, and because the exact nature of future industries is unknown, only limited predictions can be made at present as to future solid waste generation associated with industrial development. In general, it is expected that wastes that cannot be handled by the container system will be shell fish wastes (shrimp heads and hulls) and metal such as worn parts and fabrication remnants. It can be expected that metal will be collected at the site and removed at intervals by truck or barge for recycling.

Shellfish waste disposal is a problem at several locations along Bayou Lafourche. No entirely satisfactory or economically feasible methods of disposal have yet been found, although considerable moneys and effort have been expended in search of such methods. Methods have ranged from disposal in Bayou Lafourche to land application. No apparent problems have resulted from disposal in Bayou Lafourche. Although the shell fish waste increases the biological oxygen demand, the aquatic ecosystem has not been streseed to the point that fish kills occur. A major reason that adverse affects of such disposal are limited is that much of the shellfish waste is consumed immediately by scavenging fishes such as catfish.

SECTION G: HUMAN POPULATION

A. DESCRIPTION

Lafourche Parish is among the state's largest (1141 sq mi) and ranks 12th in population. In 1975 it had an approximate population of 72,028 with an average population density of 58.4 persons per sq mi, or a gross density of 0.1 persons per acre. The majority of the parish population is concentrated in a lineal development corridor on both natural levees of Bayou Lafourche, the highest and most suitable land for residential use. Net density, considering only the most desirable land, is much greater than for the parish as a whole. The density of the developed area of Lafourche Parish is 250.3 persons per sq mi. The residential pattern for the parish is largely rural, with the city of Thibodaux, the parish seat, representing the most urbanized area (14,925 in 1970). Although the parish is rural in character, population increased at a rate twice that of the State of Louisiana for the 1960-70 decade. For the first five years of this decade the rate of growth for the parish is almost five times that of the State of Louisiana as shown in Table G-1.

Table G-1. Population increases 1960-1970, Lafourche Parish and Louisiana.

	POPULATION GROWTH 1960	1970	% Change 1960-1970
Lafourche Parish	55,381	68,941	+ 24.5
Louisiana	3,256,982	3,641,306	+ 11.8

Source: South Central Planning and Development Commission, 1974a.

In 1970 the population composition of the parish was 89 percent white and 11 percent non-white, or about the same ratio as that for the whole United States. Between 1930 and 1970 the white population grew at a rate of 2.1 percent as compared to 1.0 percent annual growth for the non-white population. This is probably because of a wide divergence of immigration rates. Population characteristics of Lafourche Parish as compared to Louisiana in 1970 are shown in Table G-2.

Table G-2. Population characteristics of Lafourche Parish compared to Louisiana (1970).

Population	Lafourche Parish	Louisiana
1970	68,941	3,643,180
1960	55,381	3,257,022
Growth (Percent)	24.5	11.9
White		
Number	61,041	2,541,070
Percent	89.0	70.0
Non-White		
Number	7,900	1,102,110
Percent	11.0	30.0
Urban		
Number	26,753	2,406,150
Percent	39.0	66.0
Rural		
Number	42,188	1,235,156
Percent	61.0	34.0
Persons Per Square Mile	60.4	81.0

Source: U.S. Bureau of the Census, 1973.

Projected populations for Lafourche Parish through 1985 (using the cohort-survival technique), based on age, sex, and racial composition, birth rate and death rate for specific age-sex-race groups, and net migration data,are presented in Table G-3.

Table G-3. Projected population - Lafourche Parish.

Year	Projected Population	Projected Annual Rate of Increase	Projected Population Density per square/mile
1970	68941	.85%	49
1975	71906	1.00%	51
1980	75593	.93%	54
1985	79175		57

Source: Burford and Murzyn, 1972.

Population for Lafourche Parish and Ward 10 (the location of the proposed development) for the years 1960 to 1975, and projected populations for the years 1980, 1985, and 1990 are presented in Table G-4. Most of the population in this ward is concentrated in areas north of the site. The only concentration of population in the vicinity of the project is on Grand Isle, Ward 11 of Jefferson Parish; Grand Isle had a 1970 population of 2,236.

Table G-4. Population Lafourche Parish and Ward 10.

	Lafourche Parish	Ward 10	% Parish
1960	55,381*	15,596*	28.1
% change	24.1	20.7	-.7
1970	68,941*	18,831*	27.4
% change	4.3	3.1	-.4
1975	71,906**	19,415***	27.0
% change	5.1	5.1	----
1980	75,593**	20,410***	27.0
% change	4.7	4.7	----
1985	79,175**	21,377***	27.0
% change	5.0	5.0	----
1990	83,134***	22,466***	27.0
% change			

Source: *U.S. Bureau of the Census, 1973.
**Burford and Murzyn, 1972.
***Diversified Economic and Planning Associates, Inc., 1974.

B. ECONOMY

Lafourche Parish is one of the most productive parishes in coastal Louisiana. Its abundant hydrocarbon deposits and its estuaries comprise a significant part of the state's most productive resources. Bayou Lafourche, the major inland waterway in the parish, provides the necessary support for its future industrial growth. Its natural scenic beauty of bayous, swamps, lakes, and marshes offers a unique setting for recreational opportunities.

The major commercial activities in the parish are agriculture and fisheries, mining, manufacturing, transportation, communications, construction, trade, finance, insurance and real estate, services and miscellaneous, and unclassified establishments.

Employment is heavily concentrated around retail trade (20.1%), closely followed by manufacturing (15.02%), and oil and gas extraction (10.92%), (Table G-5). The total employment in Social Security concerned jobs was 11,916 for the first quarter of 1972; this does not include government employees, railroad employees, and self-employed persons. Payroll distribution for Lafourche Parish shows that transportation, manufacturing (mainly food products), oil and gas, and retail trade, in that order, are the principal contributors of taxable payrolls in the parish (Table G-6).

A comparison of the present distribution of employment by industry division in Lafourche Parish, Louisiana, and the United States is shown in Table G-5. Lafourche Parish shows activity in transportation well above the state and the national level, but lower levels in finance and services.

1. Income

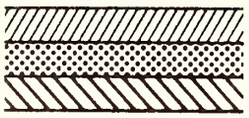
Lafourche Parish had its greater percentage of families earning over $7,000 and over $10,000 in 1969. It also had a smaller percentage of people making below $5,000 and $3,000 than the state average (see Table G-7 and G-8).

a) Agriculture

Although the character of Lafourche Parish is rural, only 66,789 acres (0.49%) of the total 786,594 acres* are classified as agricultural lands; this reflects the high percentage (65%) of the land which is wetland and undeveloped. Agriculture mainly takes place in the northern part of the parish; sugarcane is the principal crop.

*Discrepancies in total land acreage between these figures and those shown above are due to different sources of information.

Table G-5 Percentage distribution of employment by major industry in Lafourche Parish.



Industry

AGRICULTURE, FORESTRY, AND FISHERIES	2.30	0.6	0.4
CRUDE OIL, GAS, AND MINING	10.92	5.75	1.02
CONTRACT CONSTRUCTION	5.9	8.8	5.8
MANUFACTURING	15.02	20.2	32.3
TRANSPORTATION AND OTHER PUBLIC UTILITIES	20.1	9.9	6.7
WHOLESALE TRADE	7.0	8.3	7.0
RETAIL TRADE	20.1	20.7	20.1
FINANCE, INS., AND REAL ESTATE	4.3	6.3	6.8
SERVICES	13.2	18.3	19.1
UNCLASSIFIED ESTABLISHMENTS	0.9	1.0	0.8

Source: Public Affairs Research Council, Inc., 1973; and U.S. Bureau of the Census, 1972.

B. ECONOMY

Lafourche Parish is one of the most productive parishes in coastal Louisiana. Its abundant hydrocarbon deposits and its estuaries comprise a significant part of the state's most productive resources. Bayou Lafourche, the major inland waterway in the parish, provides the necessary support for its future industrial growth. Its natural scenic beauty of bayous, swamps, lakes, and marshes offers a unique setting for recreational opportunities.

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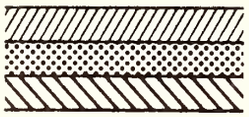

Industry

Industry	LAFOURCHE PARISH	LOUISIANA	UNITED STATES
AGRICULTURE, FORESTRY, AND FISHERIES	2.30	0.6	0.4
CRUDE OIL, GAS, AND MINING	10.92	5.75	1.02
CONTRACT CONSTRUCTION	5.9	8.8	5.8
MANUFACTURING	15.02	20.2	32.3
TRANSPORTATION AND OTHER PUBLIC UTILITIES	20.1	9.9	6.7
WHOLESALE TRADE	7.0	8.3	7.0
RETAIL TRADE	20.1	20.7	20.1
FINANCE, INS., AND REAL ESTATE	4.3	6.3	6.8
SERVICES	13.2	18.3	19.1
UNCLASSIFIED ESTABLISHMENTS	0.9	1.0	0.8

Source: Public Affairs Research Council, Inc., 1973; and U.S. Bureau of the Census, 1972.

Table G-6. Payroll distribution in Lafourche Parish, Louisiana, and the United States, January - March, 1972 (thousands of dollars).

Region Industry	Lafourche Parish	Louisiana	United States
Agriculture, Forestry & Fisheries	373	5,015	257,942
Crude Oil, Gas & Mining	2,955	123,627	1,484,882
Contract Construction	1,014	146,921	7,837,779
Manufacturing	3,121	363,846	41,146,012
Transportation & Other Public Utilities	3,886	152,841	9,381,966
Wholesale Trade	1,026	138,782	9,316,346
Retail Trade	2,557	193,561	14,094,066
Finance, Insurance & Real State	862	93,847	7,655,764
Services	1,886	191,804	16,270,282
Unclassified Establishments	139	9,450	629,813
Total	17,819	1,419,694	108,074,852

Source: U.S. Bureau of the Census, 1972.

Table G-7. Families at various income levels, Lafourche Parish, 1969.

Families at Various Income Levels	1959 Number	1959 % of Total	1969 Number	1969 % of Total
All families	13,099	100.0	16,279	100.0
Under $1,000	825	6.3	436	2.7
$1,000-$1,999	1,576	12.1	765	4.7
$2,000-$2,999	1,678	12.8	936	5.7
$3,000-$3,999	1,886	14.4	979	6.0
$4,000-$4,999	1,772	13.5	1,184	7.3
$5,000-$5,999	1,437	11.0	1,203	7.4
$6,000-$6,999	1,181	9.0	1,420	8.7
$7,000-$9,999	1,746	13.3	4,247	26.1
$10,000 and over	998	7.6	5,109	31.4
Income not reported	--	--	--	--
Below poverty level*	Not Available		2,511	15.4

Source: Public Affairs Research Council of Louisiana, Inc., 1973.

Table G-8. Percent of families with incomes under $3,000 and $10,000 and over, Lafourche Parish, Louisiana and the U.S.A., 1969.

Percent of Families With Incomes Under $3,000 and $10,000 and Over	Percent of Total Under $3,000 1959	Percent of Total Under $3,000 1969	Percent of Total $10,000 and Over 1959	Percent of Total $10,000 and Over 1969
Parish	31.1	13.1	7.6	31.4
Louisiana	35.6	18.9	9.9	33.6
United States	21.4	10.3	15.1	47.3

Source: Public Affairs Research Council of Louisiana, Inc., 1973.

Selected agriculture statistics for Lafourche Parish, Louisiana, are shown on Table G-9. There is no agricultural activity in the Port Fourchon area because the nature of the soils is not suitable.

Table G-9. Selected agricultural statistics for Lafourche Parish, Louisiana (1974 and 1969).

	1974	1969
Number of Farms	356	519
Average Size in Acres	573	394
Percent of Area in Farms	27.9	28.0
Value of Land and Buildings Per Farm	$108,349	$90,295
Value of Farm Products Sold ($1,000)	34,395	7,442

Source: U.S. Bureau of the Census, 1977.

b) Fisheries

The commercial fishing industry in Louisiana is among the largest in the United States. In 1973, Louisiana led all states in volume of landings. However, for the same year, Alaska led all states in value of landings, followed by California and Louisiana. Commercial landings of fish and shellfish in Louisiana were around 1.04 billion pounds, valued at a record of $96.9 million (Table G-10).

The principal commercial fish landing ports of Louisiana are at Cameron, Dulac-Chauvin, Morgan City, Empire, and Golden Meadow. Golden Meadow is just 20 mi north of the Port Fourchon area.

These ports were among the ten most active commercial fishing ports of the United States, accounting in 1973 for landings of 829.8 million pounds of fish and shellfish valued at $60.11 million (Table G-11). The leading species in Louisiana landings in the past five years were shrimp and menhaden. In 1973 shrimp landings were 58.6 million pounds valued at $44.5 million. In 1974 shrimp landings were 59.9 million pounds valued at $52.1 million. Lafourche Parish ranks second only to Terrebonne Parish in volume produce of shrimp along Louisiana's Gulf Coast (Table G-12).

The third most valuable fishing in Louisiana is the oyster industry. In 1973, oyster landings in the state were 8.95 million pounds of meat valued at $5.5 million, representing an increase in both volume and value over 1972 figures. In 1974, oyster landings were 8.9 million pounds of meat valued at $5.7 million representing a slight increase over 1973 figures.

Table G-10. Total commercial landings of fish and shellfish in Louisiana (1971-1973).

	Fresh Water Fish	Salt Water Fish	Shellfish	Grand Total
1971				
Thousand Pounds	9,132	1,245,862	122,019	1,377,013
Thousand Dollars	1,816	20,838	50,763	73,417
1972				
Thousand Pounds	8,996	959,157	113,117	1,081,270
Thousand Dollars	1,878	16,658	54,777	73,313
1973				
Thousand Pounds	10,254	929,236	101,307	1,040,797
Thousand Dollars	2,353	39,420	55,105	96,878

Source: U.S. Department of Interior, Bureau of Commercial Fisheries, 1971, 1972, 1973.

Table G-11. Quantity and value of commercial landings at certain Louisiana fishing ports (1971-1973).

	Cameron	Dulac-Chauvin	Empire	Morgan City	Golden Meadow
1971					
Thousand Pounds	427,600	269,000	186,100	202,700	Not Recorded
Thousand Dollars	11,800	14,700	8,700	9,100	Not Recorded
1972					
Thousand Pounds	394,500	183,000	134,000	128,600	37,900
Thousand Dollars	11,200	14,000	7,700	8,100	9,100
1973					
Thousand Pounds	336,196	188,330	176,814	95,914	32,565
Thousand Dollars	10,505	20,500	13,375	6,872	8,862

Note: Data are not intended to show the relative position of ports.

Source: U.S. Department of Interior, Bureau of Commercial Fisheries, 1971, 1972, 1973.

Table G-12. Volume of shrimp landings (Heads-Off Basis) reported in Lafourche and Terrebonne Parishes, Louisiana 1967-1971.

Year	Lafourche	Terrebonne
1967	7,786,673	13,199,438
1968	7,165,628	10,937,655
1969	8,088,204	14,139,519
1970	9,902,675	15,629,867
1971	9,981,095	17,490,653

Source: Roy and Bordelon, 1974.

In 1971, 2,363,900 pounds of oysters were harvested in Lafourche Parish; this represents the best year in quantity since 1964 and the best year in value ($1,031,267). In 1964, 2,374,000 pounds were harvested with a value of $664,440 as shown in Table G-13.

Table G-13. Quantity and value of oyster landings, Lafourche Parish, Louisiana. Selected years (1967-1971).

Year	Quantity (pounds)	Value (Dollars)
1964	2,374,000	655,400
1965	96,000	29,100
1966	161,400	73,800
1967	630,900	198,039
1968	1,240,200	399,892
1969	733,500	319,112
1970	404,800	160,600
1971	2,363,900	1,031,267

Source: Stone, James, et al., 1973.

The crab fishery industry is also important in Lafourche Parish. It has tremendous potential for growth since this fishery resource is bountiful in Louisiana waters.

Other species caught in Lafourche waters include buffalo fish, carp, catfish and bullheads, flounder, drum, sea trout, snapper, Spanish mackerel, crayfish, squid, turtle, frogs, and many others. Combined, these

species have a meaningful volume and monetary value within the fishery resources. A large segment of the south Lafourche Parish population is employed in fishing or seafood related industries. Average wages and employment for Lafourche Parish in fisheries, canned and cured seafoods, and fresh or frozen packaged fish industries for selected years are shown in Table G-14.

Table G-14. Total and average wages and employment in fisheries; canned and cured seafoods; and fish processing and packaging industries in Lafourche Parish. Selected years (1968-1972).

Year	Fisheries	Canned and Cured Seafood Fish Processing and Packaging Industries
1968		
Employment	98	72
Total Wages	557,563	113,582
Average Wages	5,689	1,578
1969		
Employment	94	79
Total Wages	586,119	157,690
Average Wages	6,235	1,996
1970		
Employment	72	81
Total Wages	505,641	188,591
Average Wages	7,023	2,328
1971		
Employment	103	69
Total Wages	643,223	184,168
Average Wages	6,245	2,669
1972		
Employment	261	59
Total Wages	2,434,528	188,813
Average Wages	9,238	3,200

Source: Stone, James, et al., 1973.

Many of the fishery resources are estuarine dependent forms, therefore modification and destruction of marshes contributes to the decline of these resources. This decline, in turn, affects the economy of the parish and the state.

c) Mineral Extraction

The principal mineral resources in the study area are fossil fuels: petroleum, natural gas, and natural gas liquids. Sulphur is also mined. For a number of years the extraction of crude oil and natural gas has been a major industry in coastal Louisiana and has brought a number of related petrochemical industries into the state. Fossil fuels are rapidly being depleted onshore increasing the need for offshore exploration and production in order to meet the nation's energy demands. The volume of oil and gas production for Lafourche Parish in 1970, when it ranked third among the parishes in the state in the value of mineral production, is shown on Table G-15 and G-16.

Table G-15. Oil and gas production in Lafourche Parish compared to Louisiana (1970).

	Crude Oil (Barrels)[a]	Condensate (Barrels)[a]	Casinghead Gas[b] (Mcf)	Natural Gas[b] (Mcf)
Louisiana (000)	787,138	117,699	1,104,941	6,691,805
Lafourche Parish (000)	117,674	8,272	138,586	296,994
Percent of Louisiana	14.9	7.0	12.5	4.4

[a]42 Gallon Barrel; [b]15.025 pounds per square inch absolute.

Source: Louisiana Department of Conservation, 1972.

Table G-16. Petroleum, natural gas, sulphur, natural gas liquid (Minerals in order of value), 1973-1974.

	1973	1974
Lafourche	$439,940	$582,091
Louisiana		$8,150,000*

* Louisiana, 96.4% of total mineral production value was crude oil, natural gas, and natural gas liquids.

Source: Louisiana Department of Conservation, 1976.

Production figures for offshore areas fronting the Port Fourchon area, when compared to Louisiana offshore totals, represent 31.5 percent of the total production and account for 8.5 percent of the state total tax revenue derived from offshore operations (Table G-17).

As indicated before in Table G-5, 10.92 percent of the total work-force in the parish representing a payroll of $2,955,000 was involved directly in mining operations in 1972. Indirectly there are many jobs, such as construction and transportation activities, associated with the petroleum industry.

d) Manufacturing

Included in manufacturing are: food and kindred products, sugar, raw cane sugar, cane sugar refining, paper and allied products, paper mills (excluding building paper), machinery (excluding electrical), farm machinery, transportation equipment, and ship and boat building and repairing. Manufacturing accounted for 1,790 employees in the first quarter of 1972 in the parish. This represents 15.02 percent of the total 11,916 persons employed at the time. Manufacturers in Lafourche Parish and in the area around Port Fourchon are shown in Table G-18.

e) Retail and Wholesale Trade

The retail and wholesale trade segment of the economy accounted for 3,231 jobs, 27.1 percent of the estimated work-force in Lafourche Parish for the first quarter of 1972.

f) Services

Services employed 13.20 percent of the work force in the parish in the first quarter of 1972. This section accounted for the lowest paid job in the state; the average weekly wage was $91 in 1972.

g) Economic Growth

Projections of economic growth are somewhat difficult to assess because of the many variables involved and unpredicted changes that might occur in the area.

Mineral resources, on which a large segment of the economy is dependent, are rapidly being depleted posing a danger to the parish of becoming more economically depressed. The development of the superport off the mouth of Bayou Lafourche could, on the other hand, mean more employment opportunities resulting in additional parish income (Gulf South Research Institute, 1974). The development of the Port Fourchon facility is another factor which would economically contribute to the growth of the parish.

Table G-17. Crude petroleum production and wells completed in Lafourche Parish, by area (1938-1970).

Area	Number of Oil Wells	Number of Gas Wells	Number of Dry Wells	Total Footage Drilled	Crude Petroleum Production (000 Barrels)*
Bay Marchand	840	46	143	6,832,427	291,407
South Pelto	85	11	61	1,215,131	13,327
South Timbalier	593	151	268	8,196,283	232,335
Grand Isle	1,005	155	285	10,332,231	310,084
Port Fourchon Area Total	2,523	363	757	26,576,072	847,153
Louisiana Offshore Total	9,352	2,793	4,200	122,359,825	2,686,516
Port Fourchon Area Percent	27.0	13.0	18.0	21.7	31.5

*42 gallon barrels

Source: Louisiana Department of Conservation, 1972; and Mineral Industry Surveys, Bureau of Mines, 1970.

Table G-18. Manufacturers in the Port Fourchon area (1972).

Location	Product Description	Number of Employees
Leeville	Fresh and frozen shrimp	20-49
Grand Isle	Concrete	20-49
Golden Meadow	Fresh and frozen shrimp	90-197
Golden Meadow	Animal foods	40-98
Golden Meadow	Bread and pastries	20-49
Golden Meadow	Trawl boards	1-7
Golden Meadow	Machine shop, jobbing and repair	20-49
Golden Meadow	Boat repairs	8-19
Cut Off	Amphibious tractors	20-49
Larose	Steel tugs, barges, push boats, shrimp boats building and repair	40-98
Lockport	Sugar and molasses	50-99
Lockport	Soft drinks	8-19
Lockport	Pulp and paper	250-499
Lockport	Tugs, push boats, barges, offshore support vessels, marine repair	[illegible]-498
Mathews, Raceland	Raw sugar, refined sugar, black-strap molasses	200-498
Mathews, Raceland	Sports clothing	50-99
Thibodaux	Slaughtering plant, sausages	50-99
Thibodaux	Milk products	20-49
Thibodaux	Raw sugar, molasses	200-447
Thibodaux	Candy	50-99
Thibodaux	Soft drinks	50-99
Thibodaux	Commercial printing	20-49
Thibodaux	Pressure vessels, storage tank	100-249
Thibodaux	Tractors, side hoe ditches	200-498
Thibodaux	Machine shop services for oil and sugar industries	50-99
Thibodaux	Draglines, personnel carriers, drill rigs	50-99
Thibodaux	Small boats	20-49

Source: Gulf South Research Institute, 1974.

C. INSTITUTIONS

1. Educational Institutions

The total number of schools in Lafourche Parish as well as other selected statistics in regard to education are shown in Table G-19.

Table G-19. Selected education statistics, 1960-1970, Lafourche Parish, Louisiana.

*Total Schools	39
Number of Non-Public Schools	8
Number of Public Schools	31
Total Registration, 1968-69	19,498
Faculty/Student Ratio, Public Schools, 1968-69	1:21.6
**Median Years of School Completed by Persons 25 Years Old and Over, 1970	8.5
College Graduates: Persons 25 Years and Over, 1970 Percentage of Population	1,778 5.7

Source: *State Department of Education, 1971. **Statistical Abstract of Louisiana, 1971 and 1973.

2. Health

Lafourche Parish is considered to be ahead of the state as a whole and just slightly behind the national average in health characteristics (LOOP, Inc., 1974). Data pertinent to health in this parish is shown in Table G-20. There are no institutions within the limits of the Port Fourchon area; there are school and medical facilities from Leeville north in the communities and towns all along the development corridor of the parish.

3. Electrical Service

The Port Foruchon Area is located within the electrical service area of the Louisiana Power and Light Company. Substations and distribution lines now existing in this area are shown in Fig. A-1.

4. Telephone Service

Buried telephone cables which service the Port Fourchon Area, and belonging to Lafourche Telephone Company, are shown in Fig. A-1. The microwave tower and its service building location is also shown in this figure.

Table G-20. Composite health status indicator, Lafourche Parish, Louisiana and Nation (1971).

	Lafourche	State	U.S.
Number of physicians per 1000 population (+)	.58	.85	1.71
Infant death rate per 1000 live births (-)	17.80	24.30	19.80
Morbidity rate per 1000 population (+)	3.32	4.58	4.80
Number of deaths per 1000 caused by heart disease (-)	2.72	3.43	3.60
Number of deaths per 1000 caused by cancer (-)	1.19	1.49	1.62
Number of families below established poverty level of income (-)	15.40	21.50	10.70
Composite Health Status Indicator (-)	39.85	54.49	38.81
Rank in State	7th		

Source: LOOP, Inc., 1974.

D. DISRUPTION OF SERVICES

Construction of the project will cause minimal disruption of services. It is located away from concentrations of population and high density land uses. Movement of equipment, materials, and personnel to the site for construction and operation of the facility may increase congestion of Louisiana Highway 1 which is the main and only route to the site and to Grand Isle from the north. The project itself is located on Louisiana Highway 3090, a spur off of Highway 1 which occurs north of Grand Isle; thus, traffic to the site will not directly affect this population center.

E. RELOCATION

There will not be any displacement of people from the site of the facility or its immediate surroundings. Because there is almost total employment in the parish there is a high probability that direct employment will cause workers to migrate into the parish as a result of the Port Fourchon Facilities (GSRI, 1974) (see Table G-21).

Table G-21. Direct and indirect impact of the Port Fourchon development.

Item Affected	Direct	Indirect	Total
Population	371[a]	1,197	1,558
Household	371	371	742
Personal Income	$3,633,510	$2,634,100	$6,267,610
Bank Deposits	$ 185,000	$1,187,200	$1,372,200
New Retail Establishments	--	11	11
Employment	371	241	612
Retail Sales	$1,453,403[b]	$1,228.010	$2,681,413

[a]Due to almost total employment in the parish it is felt that all direct employment will cause workers to migrate into the parish.

[b]Retail sales cover only those sales resulting from personal spending.

The combined land and related impact of the development was thus estimated to be $16,152,723.

Source: Gulf South Research Institute, 1974.

SECTION H: TRANSPORTATION

A. HIGHWAYS

The major highway is Louisiana Highway 1 which traverses the parish along the west bank of Bayou Lafourche from Donaldsonville to Grand Isle in Jefferson Parish. The old Spanish Trail (U.S. Highway 90) crosses the parish at Raceland. Louisiana Highway 308 parallels Bayou Lafourche on its eastern bank from Donaldsonville to Golden Meadow. Louisiana Highway 3090 travels from an intersection with Louisiana Highway 1 south of Leeville down to the beach at Port Fourchon. Major highways, railroads, and waterways in Lafourche Parish are shown in Fig. A-3.

B. RAILROADS

Southern Pacific and Texas Pacific offer railroad service in the northern and central parts of the parish. Freight service goes as far south as Valentine.

C. WATERWAYS

Bayou Lafourche is an important route between the Intracoastal Waterway and the Gulf of Mexico for the transportation of petroleum products and marine activities. The mineral industry depends on the bayou for the movement of crude petroleum (Table H-1), and also as a route for crew boat and lighting services to the offshore rigs and platforms.

In a 10-year period from 1961 to 1970, the average tons shipped per year over this waterway was 2.5 million. Although the volume in tons of shrimp and oysters is not large, its economical value is of great importance for the parish; a large segment of the Lower Lafourche population is directly or indirectly dependent on the fishing industry. The Gulf Intracoastal Waterway crosses the parish at Larose. This important waterway handled a total internal tonnage of 65,467,508 tons between the Mississippi and the Sabine River in 1969. A list of the major commodities shipped during 1969 through the Louisiana segment of the Gulf Intracoastal Waterway is given in Table H-2.

To the west of the study area is the Houma navigation canal which connects the City of Houma and the Intracoastal Waterway with the Gulf of Mexico. To the east of the study area is the Barataria waterway which connects New Orleans and the Gulf Intracoastal Waterway with the Gulf of Mexico. Numerous smaller canals cross the wetlands in the vicinity of the project. These are used by oil companies for oil well maintenance and recreationists.

Table H-1. Volume of freight traffic on Bayou Lafourche (1971).

Commodity	Volume Short-Tons (000)	Percent of Total	Direction Percent Inbound	Direction Percent Outbound
Crude petroleum	454	24	74	26
Liquid sulphur	388	21	100	0
Water	295	16	27	73
Commodities	261	14	41	59
Marine shells	236	13	92	8
Other*	249	12	71	29
Total	1,883	100	68	32

* "Other" in order of importance, includes sugar; sodium hydroxide; distillate fuel oil; iron and steel pipe and tube; miscellaneous manufactured products; sand, gravel, and crushed rock; ice; and shellfish.

Source: U.S. Army Corps of Engineers, 1973.

Table H-2. Major commodities shipped on Louisiana segment of Gulf Intracoastal Water Way in 1969 (Mississippi-Sabine Rivers).

Commodities	Tonnage (2,000 Pounds/Ton)
Crude Petroleum	27,323,488
Marine Shells	6,142,084
Gasoline	5,157,008
Non-metallic Minerals	4,511,113
Basic Chemicals	3,019,073
Residual Fuel Oil	2,701,327
Distillate Fuel Oil	2,267,733
Lubricating Oils	1,200,290
Total	65,367,508

Source: U.S. Army Corps of Engineers, 1973.

D. PIPELINES

Pipelines associated with the oil and gas industry criss-cross the parish. Those that cross the Port Fourchon area are depicted in Fig. A-13.

E. AIR TRANSPORTATION

There are no airports in Lafourche Parish; there are three existing air facilities in neighboring Terrebonne Parish.

F. IMPACTS

There will be an increase in highway traffic on Highway 1 as boat crews commute from their residence to the port. However, there will be a parallel decrease in boat traffic on the more inland waterways. This trade-off is considered a benefit since automobile transportation is more fuel efficient than boat transportation. Car pools or other forms of group transport of workers could reduce traffic and fuel use further. Highway 1 is of sufficient capacity to accommodate the port traffic.

The above described shift in traffic patterns will not significantly affect land uses, especially residences, hospitals, and schools. There are no major community facilities in the vicinity of the proposed port.

Recreational use takes place in the marshes, waterways, and the beach area along the Gulf. Traffic to the port will not adversely affect recreational traffic although there will be some mixing of automobile traffic on Highways 1 and 3090. Recreational and commercial boat traffic use different launch facilities and waterways for the most part and are not in conflict.

There are no transportation plans for the area and air quality is well within present standards. Traffic should not adversely affect air quality because of favorable air circulation patterns for pollutant dispersion.

SECTION I: WILD AND SCENIC RIVERS

There are no national wild and scenic rivers or rivers designated for potential addition to the State of Louisiana Natural and Scenic River system in the project vicinity.

The designated streams closest to the project area are Bayou Penchant in Terrebonne Parish (50 mi away) and Bayou Des Allemands on the border of St. Charles and Lafourche Parishes (54 mi away). Neither stream is in the same hydrologic basin as the proposed port. No primary or secondary impacts on either streams are anticipated.

SECTION J: HISTORIC PRESERVATION

A. NATIONAL REGISTER OF HISTORIC PLACES

The National Register of Historic Places lists no sites within the Port Fourchon area. The state nominating committee has no record of recent additions or nominations to the National Register from this area.

B. ARCHEOLOGICAL AND HISTORICAL RESOURCES

A comprehensive survey of archeological and historical resources of the project area was conducted by Coastal Environments, Inc. (CEI). A report describing the methodology, findings, and recommendations was submitted to the Louisiana State Historical and Cultural Commission, State Historic Preservation Officer (SHPO)* in April, 1976. A summary of this report follows.

*Note: As a result of a recent reorganization of state government, the designated SHPO for the State of Louisiana is now the Secretary of the Department of Culture, Recreation and Tourism.

C. GENERAL ARCHEOLOGY

1. Overview of Existing Data

The meager published record of the southern Bayou Lafourche area is more reflective of the minimal amount of survey work that has been done than of the region's true archeological significance.

Initially, attempts to derive a chronological sequence for the area revolved around the geological interpretations of the former Lafourche - Mississippi course. Russell (1940) placed the Indian cultures along the original Lafourche - Mississippi course and its distributaries into an association earlier than the Bayou Cutler Complex (see Table J-1). Bayou Cutler at that time was seen as a complete cultural configuration, but has since been relegated to a coastal phase of the Coles Creek period (Phillips, 1970). A time frame earlier than Bayou Cutler would thus have seen a Baytown period connection.

In 1944, Fisk assigned the Lafourche - Mississippi to a time span equivalent to his river stages, numbered 4 through 11. This would place the delta into a broader Tchula to Coles Creek temporal span. Ford and Quimby (1945) mentioned that the Lafourche course probably was associated with the Tchula culture.

In the most complete study to date, McIntire (1958) places the Lafourche - Mississippi subdelta into an association with Plaquemine culture sites. McIntire notes at least 23 sites showing Plaquemine culture occupations for the whole Lafourche - Mississippi system. In one of the most recent reports, Saucier (1974) equates the Lafourche - Mississippi system with a time range beginning approximately 3,500 years ago, but does not show evidence of human occupation until Baytown times. The delta continued to grow during the succeeding Coles Creek and Mississippi periods. Although most of the sites recorded to date are of the Plaquemine culture, it seems likely that their initial occupation may have been during Baytown and Coles Creek times (Gagliano, Weinstein, and Burden, 1975).

Of the nine aboriginal sites recorded within 5 mi of Port Fourchon (Fig. A-2), four have been discussed in previous literature.

The sites west of Belle Pass (16 LF 7), at Bay Marchand (16 LF 8), east of Pass Fourchon (16 LF 9), and along Bayou Lafourche near Leeville (16 LF 34), were all located in the early 1950's by McIntire, and were eventually included in his report on the changing Mississippi River delta (1958).

In that report, McIntire described each of the sites by means of initial occupation maps and ceramic analysis. In regard to the varying occupations of each site, the following may be stated:

16 LF 7 - McIntire does not give an initial occupation date, but does place the site in a Plaquemine culture context. His pottery

Table J-1. Coastal Louisiana culture sequence and chronology.

STAGE	PERIOD	CULTURE	TIME INTERVAL	PHASES		
				EASTERN AREA	CENTRAL AREA	WESTERN AREA
FORMATIVE	HISTORIC	VARIOUS CULTURES	PRESENT	← VARIOUS TRIBES →		
	MISSISSIPPI	NATCHEZAN / MISSISSIPPIAN / PLAQUEMINE	1700 A.D.	DELTA NATCHEZAN	?	BAYOU CHENE
				BAYOU PETRE		
			1300 A.D.	MEDORA		HOLLY BEACH
	COLES CREEK	COLES CREEK	1000 A.D.	BAYOU RAMOS	?	JEFF DAVIS
			850 A.D.	BAYOU CUTLER		WELCH
	BAYTOWN	BAYTOWN	700 A.D.	WHITEHALL	?	ROANOKE
	MARKSVILLE	HOPEWELLIAN-MARKSVILLE	400 A.D.	GUNBOAT LANDING	MANDALAY	VEAZEY / LAKE ARTHUR
				MAGNOLIA		
			200 A.D.	SMITHFIELD	JEFFERSON ISLAND	LACASSINE
				LABRANCHE		
	TCHULA	TCHEFUNCTE	0	BEAU MIRE	LAFAYETTE	GRAND LAKE
			250 B.C.	PONTCHARTRAIN		
ARCHAIC	POVERTY POINT	POVERTY POINT	500 B.C.	GARCIA	BEAU RIVAGE	?
			1000 B.C.	BAYOU JASMINE	RABBIT ISLAND	
	LATE ARCHAIC	ARCHAIC	1500 B.C.	PEARL RIVER	COPELL	BAYOU BLUE
	MIDDLE ARCHAIC		3000 B.C.	MONTE SANO	BANANA BAYOU	?
				AMITE RIVER		
	EARLY ARCHAIC		5000 B.C.	ST. HELENA	?	?
LITHIC	LATE PALEO	PALEO-INDIAN	6000 B.C.	JONES CREEK	VATICAN	STROHE
	EARLY PALEO		8000 B.C.	?	AVERY ISLAND	?
	PRE-PROJECTILE POINT	?	10000 B.C.	?	?	?
			?			

analysis would seem to confirm this, except for the "Moundville types" and Fatherland incised which connote a later Mississippi period occupation.

16 LF 8 - No data.

16 LF 9 - No data.

16 LF 34 - McIntire gives this site an initial occupation during the early Mississippi period. Table J-2 supports this statement.

Table J-2. Percentages of decorated sherds for two sites in the Port Fourchon area, 16 LF 7 and 16 LF 34.

SHERD	16 LF 7	16 LF 34
Fatherland Incised	7.5%	15%
Moundville Types	22.5%	
Fort Walton Types	35.0%	15%
Manchac Incised	15.0%	
Plaquemine Brushed		65%
Unclassified Decorated	20.0%	5%

Source: McIntire, 1958.

Newman (1973) also briefly mentions each of these four sites. He describes each as a shell midden and gives tentative dates to three of them:

16 LF 7 - Baytown to Plaquemine culture.
16 LF 8 - Coles Creek to Mississippian.
16 LF 34 - Plaquemine culture.

Finally, Philip Phillips (1970) in his monumental work on the lower Mississippi Valley mentions two of the Port Fourchon area sites. He places 16 LF 7 and 16 LF 34 into the Bayou Petre phase of the Mississippi period.

D. TYPES OF SITES AND LOCATION

In addition to the above mentioned four sites, the archeological survey conducted for this impact statement, by means of pedestrian and boat search, revealed five new sites in the Port Fourchon area (Fig. A-2).

The following summary is derived from all of the sites, both newly discovered and previously reported:

16 LF 7 - This site is located immediately west of the west jetty of the Belle Pass channel (29°04'55"N Lat., 90°13'44"W Long. - NE 1/4 of NW 1/4 Sec. 34. T.23S, R.22E). The site has been destroyed by wave action and shoreline retreat. When first reported, it was listed as beach wash. During this survey no evidence, aside from scattered oyster shells, was observed along the beach west of Belle Pass. Currently, spoil deposits are being dumped onto the beach so that any further attempt at locating scattered sherds or stone would probably prove fruitless.

16 LF 8 - This site is located along the beach bordering the Gulf of Mexico in front of Bay Marchand (29°05'37"N Lat., 90°12'005"W Long. - Center of Sec. 26, T.22S, R.22E). The coordinates originally delineating the site location were 29°05'15"N, 90°12'05"W, and would place it about 2,000 ft out in the Gulf from the present shoreline; there is probably an error in the original coordinant location. Again beach retreat has played havoc with the site. During the course of this survey only two sherds were collected along the beach at Bay Marchand and represent what is left of a midden formed on the Lafourche delta farther out in the Gulf.

16 LF 9 - This site is located east of Pass Fourchon (29°06'23"N, 90°10'18"W - Sec. 7, T.23S, R.23E) along the beach between the pass and Bay Champagne. The original location (probably in error) is listed as 29°05'49"N, 90°10'35"W. The site is in the same state of preservation as 16 LF 7 and 8, and only wave-washed artifacts may be expected. Nothing was found by the survey team.

16 LF 34 - This site is located along the east bank of Bayou Lafourche (29°12'50"N, 90°13'35"W - SW 1/4 of NW 1/4 of Sec. 3, T.22S, R.22E). It was located when canal dredging revealed its presence. McIntire described it as a series of small middens on the natural levee of Bayou Lafourche. This survey's crew did not visit the site, but it is listed as "destroyed" by the Louisiana Archaeologic Survey and Antiquities Commission.

16 LF 82 - The site is situated on the west bank of Belle Pass (29°05'50"N, 90°13'50"W - south central portion of Sec. 22, N-Central portion of Sec. 27, T.23S, R.22E), and extends for approximately 1.4 km along the bank. The site was found during the course of the CEI survey, and can be described as a wave-washed oyster shell midden. No evidence

of in situ material could be seen. The site is about 0.3 to 0.5 m high and about 3-6 m in width. Much ceramic material was obtained and analyzed.

16 LF 83 - This is another oyster shell midden, similar to 16 LF 82, but it is located on the west bank of Bayou Lafourche (29°07'40"N, 90° 13'07"W - SW 1/4 of SE 1/4 of Sec.10, T.23S, R.22E). It ranges from 6-9 m in width and is about 15 m along the bank. The site is totally wave-washed with shell and much pottery is scattered along the banks.

16 LF 84 - Although tentatively recorded as a site this location is at a pipeline crossing on the west bank of Belle Pass (29°06'12"N, 90° 12'30"W - E 1/2 of NW 1/4 of Sec. 23, T.23S, R.22E). A lengthy (about 300 m) pile of Rangia cuneata shells has been placed along the bank to help shore it up, and these Rangia are definitely not part of a midden. However, sherds washing out of the Rangia shells were located along the northern portion of the pipeline crossing. Also associated with the sherds, but minor in comparison to the amount of Rangia, were oyster shells. The oysters and the artifacts may be eroding from a midden presently covered over by the Rangia pile. Another possibility is that the Rangia used for the pipeline crossing were removed from another Indian midden, at some unknown location, and transported along with the sherds to the bank of Belle Pass.

16 LF 85 - The CEI survey located a small (10 m long by 1 m wide) oyster shell midden on the south bank of the small bayou which courses through the marsh between Belle Pass and Pass Fourchon. The site is located at the confluence of the bayou and Belle Pass (29°06'30"N, 90°12' 05"W - S 1/2 of MW 1/4 of Sec. 23, T.23S, R.22E). The mouth of the bayou has since been silted in, however, so the site appears to be located on a little cove along the east bank of the pass. The site appears to be wave-washed, with only a few in situ material remains.

16 LF 86 - Immediately across Belle Pass from the northern portion of 16 LF 82 the survey party located a badly disturbed oystershell midden (29°06'11"N, 90°12'55"W - SE 1/4 of SE 1/4 of Sec. 22, T.23S, R. 22E). This midden lies to the north of a slip dug for an oil well location, along the east bank of Belle Pass, and has an extent of approximately 30 to 40 m and a width of about 15 or 20 m at its widest point. The midden cannot be seen from the pass, and was only located by walking back from the pass's bank.

Two levees have been constructed over the western portion of the site and run parallel to each other and to the bank of the pass. A small canal (assumed to be a pipeline canal) has also been dredged through the site, with the spoil deposits from this canal adding to the levees. It was the artifacts and oysters washing out of the levees which first brought the site to the attention of the survey team. To the east of the canal cutting through the site, a large area could be seen containing scattered oyster shells and artifacts; however, dense marsh grass prevented determination of this area's exact dimensions. From

what was seen, the area extended back from the large, westernmost levee for about 15 or 20 m. No measurements as to the depth of this deposit could be determined, but the midden in this area seems to be in situ.

In addition to these prehistoric archeological sites the CEI survey located the remains of a shrimp boat washed up on the beach fronting Bay Marchand. Although a shrimp boat is of little archeological value, its widely scattered wooden remains are interesting and may be a popular place for beach parties or campers.

E. STATUS

It may be emphatically stated that sites 16 LF 7, 8, and 9 are totally destroyed, with only slim bits of evidence for their presence remaining. Site 16 LF 7 is currently having spoil deposits from Belle Pass dumped upon it, so it is doubtful that it will yield any further information. Sites 16 LF 8 and 9 may contain some highly wave-washed artifacts, but their scientific study potential is small.

16 LF 34 was not visited by the CEI survey team; however, it lies well beyond the project area.

16 LF 82 and 83 are wave-washed sites with little to offer stratigraphically, but much to offer materially. They are fine collecting areas for artifacts and the data which can be gained from horizontally controlled collection of such artifacts should prove extremely beneficial. They are most highly important for that reason.

16 LF 84 is so small and wave-washed that it is questionable how much information can be gained from it. However, the fact that it is completely reworked has not been confidently established, and in situ artifacts and midden may still remain. If that proves to be the case, a high priority should be given to the site.

Finally, 16 LF 86 may prove to be the most significant site in the area. Aside from the western portion which has been dredged and leveed, the remainder of the site appears to be in fairly good condition. Although surface artifacts were not very plentiful, there may be more material still in place below ground. The site is also very important in that it may have been the camping area for Indians who utilized the Belle Pass region. The aerial dimensions of the site suggest such a possibility. The site is also immediately across the pass from 16 LF 82, and thus some definite relationship between the two is highly probable.

F. GENERAL HISTORICAL INFORMATION

The historical role of the Bayou Lafourche area centers around the bayou's use as a main artery for transportation and commerce in southeastern Louisiana, connecting the Mississippi River with the Gulf of Mexico and the many towns along its flanks to one another. The entire Lafourche area was settled by Spaniards, by Germans from the German coast, and by Acadians from Canada in the eighteenth century. The Acadian influence is the most strongly reflected in the present day population. The name Lafourche (the fork) is one testimonial to French influence; it is derived from the configuration in which the bayou flows from the Mississippi River at Donaldsonville. In 1904, this flow was cut off by the partial construction of a lock and dam system intended to control flood waters. A pumping station was finally built in 1955, allowing the bayou to once again distribute Mississippi River waters. The flanks of the bayou are extremely fertile and have been farmed from the earliest days of its settlements. Sugarcane farming is especially productive and this activity is a viable part of the landscape and the lifestyle in the area.

Bayou Lafourche was also active during the Civil War as it was recognized for its wealth and closeness to New Orleans.

The nearest known historic sites are the Cheniere Camanada, lying approximately 4 to 5 mi east of the proposed port site, and Jacko Bay Camp, 5½ to 7 mi to the northwest. According to Swanson (1975), the settlement at Camanada may date to the Spanish period in Louisiana when Fort Blanc was established in that area. The settlement prospered in the early 1800's when sugar plantations thrived in the area. Before the severe hurricane of 1893, Cheniere Camanada was heavily settled by fishermen with a population of about 2,000 people, the most populus area along the Louisiana Gulf shore at the time. Over 1,000 people were drowned in the storm of 1893 and the community was largely abandoned until the 1930's when a highway was built into the area.

Jacko Bay Camp was a fishing and hunting settlement located around two small bays on the northeast shore of Timbalier Bay. Twenty-seven structures are shown on the 1894 edition of the U.S. Geological Survey, Timbalier, Louisiana quadrangles. The structures were probably all built above the marsh level on pilings.

Neither of these historic sites is within the near-vicinity of the proposed port facility. The sites will not be adversely impacted by the proposed project.

G. EVALUATION OF SITES

The results of the survey and study were reviewed with representatives of the SHPO and the Greater Lafourche Port Commission.

Of the historic and prehistoric sites known to exist in the general vicinity of the proposed project, four represent possible candidates for nomination to the National Register of Historic Places. These are the Cheniere Camanada settlement, Jacko Bay Camp, Site 16 LF 82, and Site 16 LF 86. The first two are historically significant, while the latter two prehistoric sites have in situ material and potential for contributing significant information to culture history, cultural processes, and paleoenvironmental conditions of the area.

Possible adverse effects could occur at six of the prehistoric sites as a result of the project if precautionary measures are not taken. Sites 16 LF 7 and 16 LF 86 could be affected by spoil disposal. While 16 LF 7 is already so badly degraded and of such minor importance that protective measures are not warranted, Site 16 LF 86 is of National Register caliber and will be excluded from designated spoil disposal areas.

Four sites on the west bank of Belle Pass (16 LF 82, 16 LF 83, 16 LF 84, and 16 LF 85) might be endangered by future disposal of spoil resulting from maintenance dredging. This adverse impact will be averted by designating the sites as non-spoil areas.

As in most cases, secondary impacts related to accelerated erosion and vandalism, which may affect the form of the sites (16 LF 82, 16 LF 83, 16 LF 85, and 16 LF 86), are more difficult to deal with. The sites are too large and erosion too far advanced for structural measures, such as rip-rap or bulkheads, to be effective. Instead, a program of systematic data and artifact collection to be conducted over a period of years has been recommended. Survey monuments or reference points will be established (in places safe from erosion), and systematic surface collections and observations will be made at least once a year. The collecting will be controlled by area and referenced to the survey monument. In the event that special features are exposed by erosion, they will be systematically excavated and recorded.

The program will be conducted by qualified archeologists and the data deposited in the custody of the Louisiana Archeological Survey, Department of Culture, Recreation and Tourism.

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